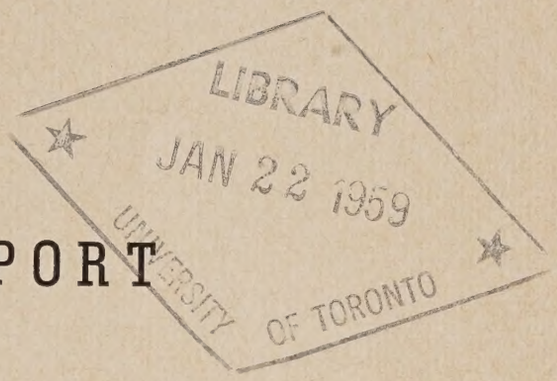

# EXPERIMENTAL FARM

## Ste. Anne de la Pocatiere, Quebec




# PROGRESS REPORT

## 1952-1956

EXPERIMENTAL FARMS SERVICE

CANADA DEPARTMENT OF AGRICULTURE
OTTAWA, ONTARIO

2M—24283—10:58
62335-5—1

## CONTENTS

## PERSONNEL

### Experimental Farm, Ste. Anne de la Pocatiere, Que.

J. R. PELLETIER, B.S.A., M.A., M.Sc., D.Sc. .... Superintendent

*Field Husbandry*

E. GODBOUT, B.A., B.S.A. ..... Crops
G. J. OUELLETTE, B.A., B.S.A., M.Sc., Ph.D. .... Soils

*Forage Crops*

L. DESSUREAUX, B.A., B.S.A., M.Sc., Ph.D. .... Breeding
J. E. CHEVRETTE, B.A., B.S.A., Ph.D. ..... Management

*Cereals*

F. M. GAUTHIER, B.S.A., M.Sc.

*Horticulture and Apiculture*

B. FOREST, B.A., B.S.A., M.Sc., Ph.D.

*Animal Husbandry*

J. P. LEMAY, B.A., B.S.A., M.Sc.

*Illustration Stations*

R. CARON, B.S.A.

*Poultry*

J. A. LEMAY

## INTRODUCTION

The previous Progress Report for this Farm was for the years 1946-1951, inclusive; the present one covers the 5-year period, 1952-1956. A varied experimental program is conducted by this Farm. The experiments deal with problems related to Animal Husbandry (dairy cattle, horses, sheep, and swine), Field Husbandry, Soils, Forage Crops, Pastures, Cereals, Horticulture, Poultry and Apiculture. In addition, nine Illustration Stations are supervised from the Experimental Farm. All these activities are designed to serve the mixed type of farming that prevails throughout eastern Quebec, in the lower St. Lawrence and the Gaspé coast.

## METEOROLOGY

The climate is of prime importance in agriculture. The effects of temperature, precipitation, evaporation, and sunshine on crop production are well known and research workers use meteorological data in the interpretation of experimental results. A summary of long-term weather records is given in Tables 1, 2, 3, 4, and 5.

The total annual precipitation for the last five years has been higher than the 44-year average. The year 1954 was abnormal because of heavy rainfall in the summer. The total annual precipitation was lowest in 1914 when only 20.6 inches was recorded, and the highest in 1954 with 52.7 inches. The annual snowfall was lowest in 1915 with 50 inches; annual rainfall was lowest in 1914 with 13.9.

During the 42-year period, 1915-1956, the average number of frost-free days was 132, whereas the average number of killing-frost-free days (above 28°F) was 160. During the same period the latest killing frost in the spring occurred about May 5 and the first killing frost in the fall around October 12. Of the last five years, 1952 had the largest number of frost-free days, and 1954 had the largest number of killing-frost-free days.

**Table 1.—Precipitation in inches at the Experimental Farm, Ste. Anne de la Pocatiere, Que.**

| Year | Jan. | Feb. | March | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual snow-fall | Annual rain-fall | Annual precipi-tation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 3.8 | 5.0 | 2.0 | 1.8 | 2.5 | 4.6 | 4.9 | 4.0 | 1.9 | 6.5 | 1.3 | 2.9 | 146.3 | 26.4 | 41.0 |
| 1953 | 3.6 | 2.4 | 4.3 | 3.1 | 2.0 | 2.6 | 4.2 | 1.7 | 4.2 | 1.9 | 2.2 | 2.3 | 94.7 | 24.8 | 34.3 |
| 1954 | 2.9 | 3.0 | 2.9 | 3.1 | 6.0 | 6.4 | 4.1 | 6.5 | 6.0 | 2.6 | 2.9 | 6.4 | 135.3 | 39.2 | 52.7 |
| 1955 | 4.1 | 3.9 | 5.9 | 3.0 | 2.5 | 1.7 | 4.7 | 3.4 | 3.6 | 1.4 | 1.8 | 2.4 | 154.7 | 23.0 | 38.5 |
| 1956 | 2.2 | 2.5 | 2.3 | 2.4 | 2.0 | 3.4 | 2.3 | 2.5 | 2.8 | 1.5 | 2.3 | 2.5 | 99.0 | 18.7 | 28.6 |
| Average 5 years | 3.3 | 3.4 | 3.5 | 2.7 | 3.0 | 3.7 | 4.0 | 3.6 | 3.7 | 2.8 | 2.1 | 3.3 | 126.0 | 26.4 | 39.0 |
| Average 44 years | 3.0 | 2.7 | 2.8 | 2.8 | 3.1 | 3.5 | 3.8 | 3.3 | 3.6 | 3.2 | 2.9 | 2.6 | 111.5 | 26.2 | 37.4 |
| Extremes 1913–1956 | | | | | | | | | | | | | | | |
| Total | 6.6 | 6.2 | 5.9 | 6.3 | 6.9 | 7.7 | 6.8 | 9.2 | 7.4 | 7.1 | 7.8 | 6.4 | 201.3 | 41.1 | 52.7 |
| Greatest precipitation year | 1951 | 1939 | 1955 | 1924 | 1947 | 1917 | 1951 | 1937 | 1941 | 1943 | 1927 | 1954 | 1942 | 1937 | 1954 |
| Total | 0.7 | 0.5 | 0.8 | 0.9 | 1.2 | 1.3 | 0.6 | 0.7 | 0.7 | 0.6 | 0.7 | 0.6 | 50.0 | 13.9 | 20.6 |
| Lightest precipitation year | 1944 | 1930 | 1915 | 1937 | 1920 | 1913 | 1914 | 1916 | 1922 | 1918 | 1939 | 1931 | 1915 | 1914 | 1914 |

**Table 2.—Air Temperature in degrees Fahrenheit recorded at the Experimental Farm, Ste. Anne de la Pocatiere, Que.**

| Year | Jan. | Feb. | March | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Extreme high temperature | Extreme low temperature | Mean annual temperature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 12 | 19 | 27 | 38 | 50 | 61 | 71 | 66 | 57 | 41 | 31 | 22 | 92 | −21 | 41 |
| 1953 | 15 | 19 | 23 | 39 | 50 | 61 | 65 | 63 | 55 | 45 | 37 | 23 | 95 | −10 | 41 |
| 1954 | 6 | 21 | 24 | 37 | 49 | 59 | 63 | 61 | 55 | 45 | 34 | 21 | 86 | −24 | 39 |
| 1955 | 11 | 13 | 21 | 37 | 51 | 62 | 67 | 66 | 54 | 45 | 32 | 12 | 95 | −27 | 39 |
| 1956 | 19 | 16 | 21 | 36 | 45 | 59 | 62 | 61 | 52 | 46 | 31 | 17 | 88 | −13 | 39 |
| Average 5 years | 13 | 17 | 23 | 37 | 49 | 60 | 66 | 63 | 55 | 45 | 33 | 19 | ..... | ..... | 40 |
| Average 44 years | 11 | 13 | 23 | 37 | 49 | 59 | 65 | 63 | 55 | 44 | 31 | 17 | ..... | ..... | 39 |
| Extremes 1913–1956 | | | | | | | | | | | | | | | |
| Highest Temperature | 54 | 49 | 61 | 82 | 88 | 95 | 95 | 93 | 89 | 81 | 70 | 58 | ..... | ..... | ..... |
| Year | 1950 | 1953 | 1945 | 1913 | 1913<br>1929 | 1919 | 1953<br>1955 | 1947 | 1916<br>1942<br>1948 | 1949 | 1927<br>1938 | 1951 | ..... | ..... | ..... |
| Lowest Temperature | −32 | −33 | −19 | −1 | 19 | 23 | 30 | 28 | 18 | 10 | −10 | −27 | ..... | ..... | ..... |
| Year | 1920 | 1914<br>1918 | 1920 | 1947 | 1927 | 1927 | 1923 | 1927 | 1927 | 1929 | 1936 | 1917<br>1919<br>1933 | ..... | ..... | ..... |
| Monthly mean Warmest | 21 | 21 | 32 | 43 | 54 | 65 | 72 | 67 | 59 | 51 | 39 | 27 | ..... | ..... | 42 |
| Year | 1933 | 1954 | 1931 | 1933 | 1942 | 1930 | 1916 | 1937 | 1934<br>1946 | 1947 | 1931 | 1923 | ..... | ..... | 1931 |
| Coldest | 1 | 3 | 13 | 29 | 41 | 53 | 60 | 57 | 46 | 38 | 22 | 7 | ..... | ..... | 35 |
| Year | 1920 | 1914 | 1916 | 1947 | 1927 | 1927 | 1918 | 1918 | 1928 | 1925 | 1933 | 1933 | ..... | ..... | 1917 |

**Table 3.—Frost data at the Experimental Farm, Ste. Anne de la Pocatiere, Que.**

| Year | Frost: 32°(F.) or lower | | | | | Killing frost: 28°(F) or lower | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Last frost in spring | | First frost in fall | | Frost-free period | Last killing frost in spring | | First killing frost in fall | | Killing-frost-free period |
| | Date | Temp. (deg.) | Date | Temp. (deg.) | (days) | Date | Temp. (deg.) | Date | Temp. (deg.) | (days) |
| 1952 | May 4 | 30 | Oct. 8 | 31 | 157 | Apr. 17 | 24 | Oct. 11 | 27 | 177 |
| 1953 | May 31 | 32 | Sept. 24 | 29 | 116 | May 3 | 27 | Oct. 11 | 25 | 161 |
| 1954 | May 12 | 32 | Oct. 2 | 31 | 143 | Apr. 28 | 28 | Oct. 23 | 28 | 178 |
| 1955 | Apr. 25 | 29 | Sept. 23 | 31 | 151 | Apr. 21 | 27 | Oct. 6 | 27 | 168 |
| 1956 | May 29 | 32 | Sept. 16 | 32 | 110 | May 11 | 24 | Sept. 26 | 27 | 138 |
| Average past 5 years | May 14 | ..... | Sept. 27 | ..... | 136 | Apr. 28 | ..... | Oct. 9 | ..... | 164 |
| Average 42 years (1915–56) | May 18 | ..... | Sept. 27 | ..... | 132 | May 5 | ..... | Oct. 12 | ..... | 160 |
| EXTREMES 1915–1956 | | | | | | | | | | |
| Longest frost-free season | May 2 | 31 | Oct. 8 | 31 | 159(1918) | Apr. 19 | 28 | Nov. 5 | 27 | 200(1918) |
| Shortest frost-free season | June 29 | 28 | Sept. 11 | 30 | 74(1927) | June 29 | 28 | Sept. 13 | 25 | 76(1927) |
| Earliest date last spring frost | Apr. 25 | 29(1955) | ..... | ..... | ..... | Apr. 17 | 24(1952) | ..... | ..... | ..... |
| Latest date late spring frost | June 29 | 28(1927) | ..... | ..... | ..... | June 29 | 28(1927) | ..... | ..... | ..... |
| Earliest date first fall frost | ..... | ..... | Sept. 7 | 32(1938) | ..... | ..... | ..... | Sept. 13 | 25(1927) | ..... |
| Latest date first fall frost | ..... | ..... | Oct. 18 | 28(1933) | ..... | ..... | ..... | Nov. 5 | 27(1917) (1931) | ..... |

62335-5—2½

**Table 4.—Hours of sunshine at the Experimental Farm, Ste. Anne de la Pocatiere**

| Year | Jan | Feb. | March | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 110 | 87 | 125 | 183 | 151 | 251 | 291 | 267 | 169 | 63 | 76 | 93 | 1,866 |
| 1953 | 82 | 87 | 121 | 123 | 254 | 222 | 275 | 207 | 101 | 118 | 57 | 51 | 1,698 |
| 1954 | 103 | 91 | 129 | 193 | 157 | 208 | 188 | 219 | 140 | 124 | 56 | 41 | 1,649 |
| 1955 | 78 | 83 | 117 | 204 | 139 | 272 | 301 | 231 | 180 | 140 | 57 | 90 | 1,892 |
| 1956 | 51 | 128 | 171 | 172 | 241 | 219 | 225 | 245 | 155 | 146 | 98 | 71 | 1,922 |
| Average 5 years | 85 | 95 | 133 | 175 | 188 | 235 | 256 | 234 | 149 | 118 | 69 | 69 | 1,806 |
| " 44 years | 86 | 109 | 140 | 167 | 207 | 214 | 252 | 230 | 156 | 114 | 70 | 70 | 1,815 |
| Extremes 1913—1956 | | | | | | | | | | | | | |
| Cloudiest Hours | 51 | 61 | 106 | 108 | 139 | 134 | 170 | 175 | 87 | 61 | 36 | 41 | 1,489 |
| months Years | 1956 | 1920 | 1932 | 1951 | 1955 | 1930 | 1932 | 1932 | 1930 | 1922 | 1929 | 1954 | 1932 |
| Sunniest Hours | 116 | 160 | 213 | 237 | 287 | 275 | 301 | 279 | 213 | 175 | 109 | 103 | 2,031 |
| months Years | 1937 | 1940 | 1918 | 1918 | 1933 | 1938 | 1955 | 1950 | 1923 | 1924 | 1917 | 1914 | 1923 |

**Table 5.—General summary of climatic data recorded at the Experimental Farm, Ste. Anne de la Pocatiere**

| Temperature (Deg.F.) 1913–1956 (44 yr.) | | | | Precipitation (in.) 1913–1956 (44 yr.) | | | Sunshine 1913–1956 (44 yr.) | Evaporation free water surface (1945–1956) (13 yr.) (in.) |
|---|---|---|---|---|---|---|---|---|
| Month | Mean | Highest | Lowest | Rain | Snow | Total precipitation | (Total hr.) | |
| January | 11 | 54 | −32 | 0.4 | 25.4 | 3.0 | 86 | ..... |
| February | 13 | 49 | −33 | 0.3 | 24.0 | 2.7 | 109 | ..... |
| March | 23 | 61 | −19 | 0.7 | 20.5 | 2.8 | 140 | ..... |
| April | 37 | 82 | −1 | 1.9 | 8.7 | 2.8 | 167 | ..... |
| May | 49 | 88 | 19 | 3.1 | 0.4 | 3.1 | 207 | 2.8 |
| June | 59 | 95 | 23 | 3.5 | ..... | 3.5 | 214 | 3.6 |
| July | 65 | 95 | 30 | 3.8 | ..... | 3.8 | 252 | 4.5 |
| August | 63 | 93 | 28 | 3.3 | ..... | 3.3 | 230 | 3.6 |
| September | 55 | 89 | 18 | 3.6 | ..... | 3.6 | 156 | 2.7 |
| October | 44 | 81 | 10 | 3.0 | 1.6 | 3.2 | 114 | ..... |
| November | 31 | 70 | −10 | 1.8 | 11.3 | 2.9 | 70 | ..... |
| December | 17 | 58 | −27 | 0.7 | 19.6 | 2.6 | 70 | ..... |
| Annual | 39 | 95 | −33 | 26.1 | 111.5 | 37.3 | 1,815 | 17.2 |

Meteorological records are taken in co-operation with the Meteorological Branch, Department of Transport.

# FIELD HUSBANDRY

## Crop Production Studies

E. GODBOUT

***Studies of effects of certain crops on others***

A sequence-of-crop experiment was conducted in duplicate on a manured Kamouraska clay soil to study the effects of oats, flax, corn, soybeans, alfalfa, timothy, red clover, and fallow on the yields of such succeeding crops as potatoes and oats. The experiment was planned to permit comparison of the yields obtained under crop rotation with those obtained by continuous cropping. The crops were grown in a 3-year rotation with oats as a third-year crop. Manure was applied at the rate of 12 tons per acre for the oat crop. The results showed that alfalfa, soybeans, corn and red clover were good preceding crops for potatoes and oats. Oats was a good preceding crop for potatoes but only fairly satisfactory for oats. Although the crop following fallow gave high yields, this practice cannot be recommended in general under our climatic conditions. Fiber flax and timothy were the poorest preceding crops. The data indicated that corn, oats, and fiber flax yielded better in a rotation of crops than under continuous cropping, whereas alfalfa and timothy gave higher yields under continuous cropping than in rotation.

***Cultural methods***

*Preparation of land for grain.*—To determine the best method of preparing the land for grain, six cultural treatments were compared. The results are given in Table 6.

**Table 6.—Preparation of land for grain on Kamouraska clay soil**

| Methods of preparation of land | Yield per acre | |
|---|---|---|
| | Wheat | Oats |
| | 17–year average | 17–year average |
| | bu. | bu. |
| Plowing 4 inches deep in August, harrowing and second plowing 7 inches deep on October 15 | 30.6 | ..... |
| Plowing 4 inches deep in August and harrowing | 29.2 | ..... |
| Plowing 7 inches deep on September 15 | 19.2 | ..... |
| Plowing 7 inches deep on October 15 | 16.8 | 39.4 |
| Plowing 4 inches deep on October 15 | 17.5 | 38.0 |
| Plowing 7 inches deep in spring | 15.5 | 36.6 |

The following conclusions can be drawn.

(1) Plowing 4 inches deep in August, harrowing, and a second plowing at 7 inches deep on October 15, was superior to all other cultural methods.

(2) Plowing 4 inches deep in August and harrowing during the fall was the next best method.

(3) Plowing on September 15 gave better results than plowing on October 15 or in the spring.

(4) Fall plowing gave slightly better results than spring plowing.

(5) There was no significant difference between plowing 4 and 7 inches deep.

***Fertilizer and manure studies on two soil types***

Commercial fertilizer was compared with farm manure for grain and hay on clay soil in a 5-year rotation, including wheat and oats in the first year, peas and oats in the second year, oats in the third year, clover and alfalfa hay in the fourth year, and timothy and alfalfa hay in the fifth year. The various treatments were applied partly to the oat crop and partly to the timothy-alfalfa hay crop, but yield results were taken for each of the crops. Each field of the rotation was divided into three plots: one plot received 16 tons of manure per acre, half of which was applied to the oat crop and half to the timothy-alfalfa hay crop; another plot received commercial fertilizer at the rate of 300 lb. of 2-12-6 or 2-16-6 for the oat crop, and an equal amount for the timothy-alfalfa crop; a third plot was left unfertilized.

On an 18-year average, commercial fertilizer and manure gave respectively 7 and 15 per cent more grain than the plot that received neither manure nor fertilizer. For hay crops, commercial fertilizer and manure gave respectively 24 and 32 per cent more hay than the check plot. Even on a fertile clay soil, manuring has proved its value for both grain and hay production.

On a sandy loam, commercial fertilizer and farm manure were compared for the production of grain and hay. The treatments were: (1) manure alone; (2) a combination of manure and commercial fertilizer; (3) a heavy application of commercial fertilizer; (4) a light application of commercial fertilizer and (5) a check plot with no treatment. A 4-year rotation was used with peas and oats hay in the first year, oats in the second, clover-alfalfa hay in the third, and timothy-alfalfa hay in the fourth. Each rotation field was divided into five plots. The plot selected for manure alone received 16 tons of manure per acre, half on the first-year crop, and half on oat stubble the following year. The plot with farm manure and commercial fertilizer received 8 tons per acre of manure and 300 lb. of superphosphate applied to the first-year crop, and 8 tons of manure applied to the second-year crop. The plot with a light application of commercial fertilizer received 475 lb. per acre of 4-12-6 applied to the first-year crop. The plot with a heavy application of commercial fertilizer received 950 lb. per acre of 4-12-6, part of which was applied in each year crop. The check plot received neither manure nor commercial fertilizer.

On this type of soil it was possible with manure or commercial fertilizer to double or even triple the yields of grain and hay crops. Results showed also the most profitable treatment was the heavy application of commercial fertilizer distributed over all crops of the rotation, followed in order by manure and fertilizer combined, and manure alone.

***Testing of fertilizers for rutabagas on a sandy loam***

An experiment was carried on for ten years to determine the value of manure, commercial fertilizer, and lime for rutabagas on sandy soil. This experiment was conducted with a 4-year rotation, including rutabagas in the first year, oats in the second, clover and alfalfa mixture in the third, and timothy-alfalfa in the fourth. The yields and total value of crops after deducting the cost of fertilizers are shown in Table 7.

**Table 7.—Yields of crops in a 4-year rotation under various fertilizer and lime treatments on sandy soil (10-year average).**

| Number of plots | Treatment and quantity per acre | Average yield of crops per acre | | | | Total value of crops after deducting cost of fertilizer |
|---|---|---|---|---|---|---|
| | | Rutabagas | Oats | Clover and Alfalfa | Timothy and Alfalfa | |
| | | tons | bu. | tons | tons | $ ¢ |
| 1 | 400 lb. 4–12–6 | 6.26 | 27.7 | 0.85 | 1.04 | 88.19 |
| 2 | 1,200 lb. 4–12–6 | 12.65 | 32.9 | 1.47 | 1.66 | 134.28 |
| 3 | 10 tons manure plus 500 lb. superphosphate | 11.59 | 39.1 | 1.76 | 2.07 | 149.89 |
| 4 | 800 lb. 4–16–6 | 10.07 | 31.0 | 1.53 | 1.76 | 130.37 |
| 5 | 720 lb. superphosphate | 9.03 | 28.3 | 1.38 | 1.47 | 118.14 |
| 6 | 20 tons manure | 11.54 | 36.1 | 1.76 | 2.04 | 139.54 |
| 7 | 20 tons manure plus 2 tons limestone | 13.20 | 44.9 | 2.16 | 2.47 | 164.99 |
| 8 | 500 lb. superphosphate plus 1 ton limestone | 8.60 | 30.4 | 1.53 | 1.82 | 127.96 |
| 9 | 10 tons manure plus 800 lb. 4–12–6 | 12.42 | 27.6 | 1.69 | 1.67 | 125.85 |
| 10 | 800 lb. 4–12–6 | 9.33 | 27.9 | 1.44 | 1.53 | 117.44 |
| 11 | 800 lb. 4–12–0 | 7.74 | 30.4 | 1.44 | 1.57 | 116.77 |
| 12 | 800 lb. 4–0–6 | 0.37 | 23.2 | 0.65 | 0.87 | 47.71 |
| 13 | 800 lb. 0–12–6 | 7.39 | 26.2 | 1.23 | 1.19 | 100.57 |
| 14 | 20 tons manure plus 500 lb. superphosphate | 13.08 | 37.3 | 1.84 | 2.05 | 142.88 |
| 15 | 20 tons manure plus 500 lb. superphosphate plus 2 tons limestone | 13.76 | 40.1 | 2.03 | 2.37 | 150.35 |
| 16 | Neither manure nor fertilizer | 0.40 | 16.4 | 0.45 | 0.65 | 39.91 |

From Table 7, it is apparent that all fertilizer treatments gave larger yields than the unfertilized check plot. Furthermore, treatments including manure gave the highest and most economical yields of rutabagas, oats, and hay. Manure and limestone applied together had the most pronounced residual effect on the grain and hay crops of any of the treatments.

***Commercial fertilizer formulae for rutabagas*** (Borax in control of brown heart)

This experiment was conducted to study the effects of fertility treatments on the development of brown heart in rutabagas and to test the value of borax in its control. Fertility treatments were the same as those given in Table 7. Results indicate that the percentage of brown heart had a tendency to be higher where there was limestone. Treatments with 4-12-6 at the rates of 800 and 1,200 lb., as well as treatment with 4-16-6 promoted brown heart development. On the other hand, manure alone, manure supplement with complete fertilizer, or superphosphate alone, produced less brown heart. Borax applied at the rate of 15 lb. per acre the day before seeding was effective in most cases. Brown heart infection was decreased 74.2 per cent by the use of 15 lb. of borax per acre.

***Manure versus commercial fertilizers for pastures on St. Andre gravelly loam***

Tests were started in 1944 with the view to improving pastures located on upland soils. These are stony, low in fertility and in moisture-holding capacity. The mixture of herbage used was composed of timothy, red clover, alsike clover, Kentucky blue grass, red top, and wild white clover. The results given in the 1946-51 Progress Report showed that a complete fertilizer (NPK) gave the greatest return measured in terms of animal gains, followed closely by manure and superphosphate.

In 1950-51, the same fields were renovated by plowing, liming at 2 tons per acre, and reseeding with a mixture containing bird's-foot trefoil and timothy or brome. Bird's-foot trefoil is a legume adapted to dry conditions and to soils of low fertility. The fertilizer treatments were as follows:

Treatment 1—100 lb. of ammonium sulphate, every spring;
600 lb. of superphosphate every 3 years, in the fall;
100 lb. of muriate of potash 60 per cent every 3 years in the fall.
Treatment 2—Check, no fertilizer, no manure.
Treatment 3—12 tons of manure every 3 years in the fall.
Treatment 4—600 lb. of superphosphate every 3 years in the fall.
Treatment 5—600 lb. of superphosphate and 100 lb. of muriate of potash every 3 years in the fall.

Yields of herbage were measured with 3-foot by 3-foot cages. The results in terms of animal gains obtained for the 5-year period 1952-56, are condensed in Table 8.

**Table 8.—Manure versus commercial fertilizers for pastures on St. Andre gravelly loam at Ste. Anne de la Pocatiere. Average 1952-56.**

| | NPK | Check | Manure | P | PK |
|---|---|---|---|---|---|
| Gain in lb. per acre of dairy heifers..... | 332.3 | 227.1 | 280.7 | 294.9 | 305.7 |
| Gain in percentage of check..... | 146 | 100 | 124 | 130 | 135 |

The complete fertilizer treatment produced 46 per cent more gain per acre than the check, which received lime alone in 1950 and nothing thereafter. The addition of a small amount of nitrogen in the spring to one of the plots was responsible for the gain difference of 11 per cent between NPK and PK. Dressing with superphosphate or manure also brought about substantial improvement, whereas the addition of potassium produced no significant increase.

These results confirm previous findings, that it is possible to increase greatly the productivity of upland pasture with modest applications of fertilizers, especially phosphorus, nitrogen, or manure.

***Experiments on Herbicides***

*Effect of 2,4-D on cereal grains.*—From 1950 to 1952, ester and amine formulations of 2,4-D at the rates of 4 and 8 ounces acid equivalent per acre were compared at 16 various growth stages on two oat varieties in two replicates. The spraying was done when possible at 3- or 4-day intervals, from 4 days after seeding till the onset of heading.

*Conclusions.*—In general, the ester formulation reduced yields, affected head formation, delayed maturity, and reduced the height of oats more than amine. For both formulations, the 8-ounce rate affected yields more than the 4-ounce rate. For two formulations and two rates of 2,4-D, there was no

significant difference in yield between Erban and Ajax oats. The best post-emergence growth stages for spraying oats (without considering the effect on the weeds) were the 2- and 3-leaf stages, followed by the early heading stage. The most damage occurred at the 5- and 6-leaf stages, followed by the shot-blade stage.

*Effect of 2,4-D and M.C.P. on field crops.*—A 3-year (1953-55) experiment was undertaken to test the effectiveness of amine and ester formulations of 2,4-D, and amine, ester, and sodium salt formulations of M.C.P. when applied to barley and oats seeded to a legume mixture for hay. The spray material was applied on both cereals at the rate of 4 ounces acid equivalent per acre, when the grain crops were 6 to 8 inches high, that is at 3-leaf stage. At this time the forage seedlings and weeds were 1 inch high.

*Results.*—A 3-year average indicates that the various herbicides under investigation did not significantly affect the yields of barley and oats, nor did they materially affect either the fall or the spring stand of red clover and alfalfa mixture, except in the case of the 2,4-D ester where the 2-year average stand was decreased by 7.8 per cent as compared with the check. The hay yields were not affected, except by the 2,4-D ester treatment which resulted in a 2-year average decrease of 7.8 per cent as compared with the check. It should be pointed out that the above-mentioned herbicides used at the rates indicated had no effect on common chickweed and sun spurge, the main weeds found in the two cereals under treatment.

***Silage trials with various forage crops***

*Corn.*—Corn when cut and put in the silo before it was dry, or before the first September frost, kept well without the addition of water. However, when the corn dried in the field before it was cut, the resulting silage had a tendency to become moldy. Under these conditions the addition of water to restore the moisture content improved the keeping quality.

*Grass silages.*—Pure red clover and pure ladino clover, cut at an early stage of growth, were, in general, difficult to keep because of their high protein and moisture content.

A mixture of alfalfa and red clover was easier to keep when maturity was delayed or when the moisture content was not too high.

An alfalfa–brome grass mixture was easier to conserve, even at an early stage, than legumes alone.

In general, the trials on grass silages showed that legumes, or hay mixtures including a high proportion of legumes, must not be cut too early and must be partially dried in the field after cutting to reduce their moisture content. Preservatives, such as sodium metabisulfite and P.C.A. Mix powder helped in preservation but did not assure excellent conservation when the above-mentioned factors were omitted. The best results with grass silage were obtained by using a 50-50 grass-legume mixture, partially dried to about 70 per cent moisture, or even 65 per cent, provided that it was well packed. However, the results of the two last years indicate that a good silage can be produced from early cut hay without partial drying, provided the grass–legume mixture does not contain more than 40 per cent of legume and 78 per cent moisture.

*Losses of corn in silo.*—Over a 13-year period, average losses from fermentation, and spoiled silage in the middle of the silo, based on a total of 856 tons of corn, were about 23.6 per cent on a green-matter basis, and 17.8 per cent on a dry-matter basis. The top losses were 6 per cent. For the last four years, losses were 23.5 per cent on green-matter basis and 19.8 per cent on dry-matter basis. The top losses amounted to 4.8 per cent.

*Losses of grass silage in tower silo.*—Over a 14-year period, average losses by fermentation and spoiled silage in the middle of the silo, based on a total of 693 tons of grass silage, were 19.7 per cent on a green-matter basis, and 17.7 per cent on a dry-matter basis.

For the last five years, losses were 19.8 per cent on green-matter basis and 16.8 per cent on dry-matter basis. The top losses amounted to 3.2 per cent.

*Losses of uncut grass silage in trench silo.*—For a 2-year average, losses based on a total of 107 tons of uncut hay were 28.9 per cent on a green-matter basis and 32.1 per cent on a dry-matter basis. However, it should be noted that this silo was not covered.

*Silage preservatives.*—From 1954 to 1956, grass silage (equal parts of grass and legume) with a rather high moisture content was put up under three different treatments—P.C.A. Mix, sodium metabisulfite at 5 lb. rate per ton, and the control. Silage resulting from these treatments was quite similar in color and palatability; that preserved with sodium metabisulfite had the most pleasant odor. From these trials, it would appear that the preservatives, P.C.A. Mix and sodium metabisulfite resulted in the preservation of more T.D.N. than the untreated silage.

***Stages of cutting alfalfa***

From 1949 to 1954, an experiment was conducted to determine the best stage of cutting alfalfa from the standpoint of the quantity and quality of the crop. The various stages were (*a*) four times a year to simulate pasture (*b*) bud stage (*c*) before blooming (*d*) early bloom and (*e*) full bloom.

The results indicate that the earlier the stage of cutting, the more nutritious the crop. When clipped as pasture, alfalfa contained as high as 26 per cent of crude protein whereas in full bloom, protein dropped to 14 per cent. Alfalfa also contained more fat and ash when cut at early stages. Conversely the percentage of fiber increased with maturity.

On the other hand, yields of dry matter increased gradually with later cuttings. The increase was most striking between the stages "before blooming" and "early bloom". A later harvest at "full bloom" did not increase yields materially. Taking into consideration the nutritive value of the crop and the total herbage production, cutting at the "early bloom" stage is to be recommended.

The various treatments affected the second and succeeding yields of alfalfa. The year following cuttings at early stages, alfalfa was less vigorous, grew less rapidly, and came into bloom a few days later. After a couple of years of such treatments winterkilling was more pronounced where alfalfa was clipped at early stages than when cut in early or full bloom. Cutting alfalfa in mid-September was detrimental and resulted in loss of vigor and severe winter damage. Cutting should be done either at the end of August or in October.

## Soil Fertility

G. J. Ouellette

***Nature of alfalfa tolerance to soil acidity***

Following the theory that in acid soils the toxicity of the elements manganese and aluminum is one of the main factors that inhibit the growth of most plants, particularly legumes, work was conducted in which a considerable amount of variation was found in the tolerance of four clonal lines of alfalfa to toxic concentrations of these two elements. In an attempt to study the nature of this tolerance, the chemical composition of alfalfa as related to response to various concentrations of manganese, aluminum, and calcium in the sand culture, was determined.

The content of manganese and aluminum in the entire plant, roots and above-ground parts, was approximately constant for all clonal lines studied, regardless of their degree of tolerance. Considerable differences, however, were observed in the distribution of these elements within the plants. The more tolerant clones contained less total manganese and aluminum in their stems and leaves and more in their roots than the less tolerant. Therefore, the differential translocation of these elements from the roots to the above-ground parts of the plants appeared to account for the different degrees of tolerance noted between the clonal lines studied. Moreover, for a given content of manganese and aluminum in the top growth the injury was approximately the same for all plants, regardless of their degree of tolerance.

An increase in the calcium concentration of the nutrient culture counteracted to some extent the toxic effects of manganese and aluminum, and the plants that grew best in toxic concentrations of the latter two elements contained more total as well as water-soluble calcium than the others. It is suggested therefore that the rate of uptake of calcium by alfalfa is one of the factors determining its degree of tolerance to manganese and aluminum toxicity. In that connection, it is believed that calcium acts on manganese and aluminum as a precipitating agent, thus immobilizing within the roots a part of the excess of manganese and aluminum absorbed.

Figure 1—The alfalfa plant on the left exhibits some definite symptoms of manganese toxicity (chlorosis, necrosis, cupping and crinkling of the leaves); the plant on the right is normal.

***Lack of boron a major problem in the cultivation of alfalfa in Quebec***

Of the 266 fields of alfalfa surveyed in Quebec from 1950 to 1953, inclusive, 119 or 45 per cent contained plants showing boron deficiency symptoms. As a rule, from 5 to 15 per cent of the plants were affected, but this ran as high as 50 per cent in some fields. Alfalfa plants containing over 15 parts per million of total boron were consistently free from any observable symptoms, while in those with less than 10 parts per million, symptoms were visible on the foliage.

As shown in Table 9, a much greater proportion of the sandy than of the clayey soils surveyed were too low in available boron to permit normal growth of alfalfa. In fact, the average water-soluble boron content of the coarse-

textured soils associated with deficiency symptoms was 0.34 pound per acre, whereas that of the fine-textured soils was 0.60 pound per acre. However, the ranges of boron content in the soils on which normal as well as boron-deficient alfalfa grew seem to indicate that the clayey soils of Quebec must contain more water-soluble boron than the sandy soils in order to support normal alfalfa. These critical levels in the water-soluble boron of the plow-layer seem to be approximately 0.5 pound per acre for the sandy soils and 0.8 pound for the clayey soils.

**Table 9.—Occurrence of boron deficiency symptoms on alfalfa and water-soluble boron content of the soil in relation to the texture of 261 fields surveyed during the years 1950, 1951, 1952, and 1953.**

| Soil texture | Total number of samples | Samples associated with symptoms | | Water-soluble boron in soil | | | |
|---|---|---|---|---|---|---|---|
| | | | | Symptoms present | | Symptoms absent | |
| | | Number | Percentage | Lb./acre | Range | Lb./acre | Range |
| Coarse..... | 138 | 84 | 61 | 0.34 | 0.0–0.6 | 1.63 | 0.3–4.8 |
| Medium..... | 58 | 26 | 45 | 0.48 | 0.1–0.8 | 1.14 | 0.5–3.1 |
| Fine..... | 65 | 9 | 14 | 0.60 | 0.3–0.8 | 1.49 | 0.7–5.3 |

***Response of alfalfa to boron applications***

A minor-element deficiency such as that of boron in alfalfa may cause greater yield decreases than is generally believed. For example, a 25-pound annual application of borax to St. Pacôme sandy loam increased the yields of hay by about 22 per cent over the period from 1951 to 1955. Seed yield responses were even more striking. Check yields of 51 pounds per acre were increased to 128 pounds, a 250 per cent increase, by the same application of borax.

Figure 2 shows how alfalfa reacts to various concentrations of soluble boron in sand cultures. It is to be noted that 0.25 parts per million of soluble boron is far from sufficient to bring about maximum yields of alfalfa hay.

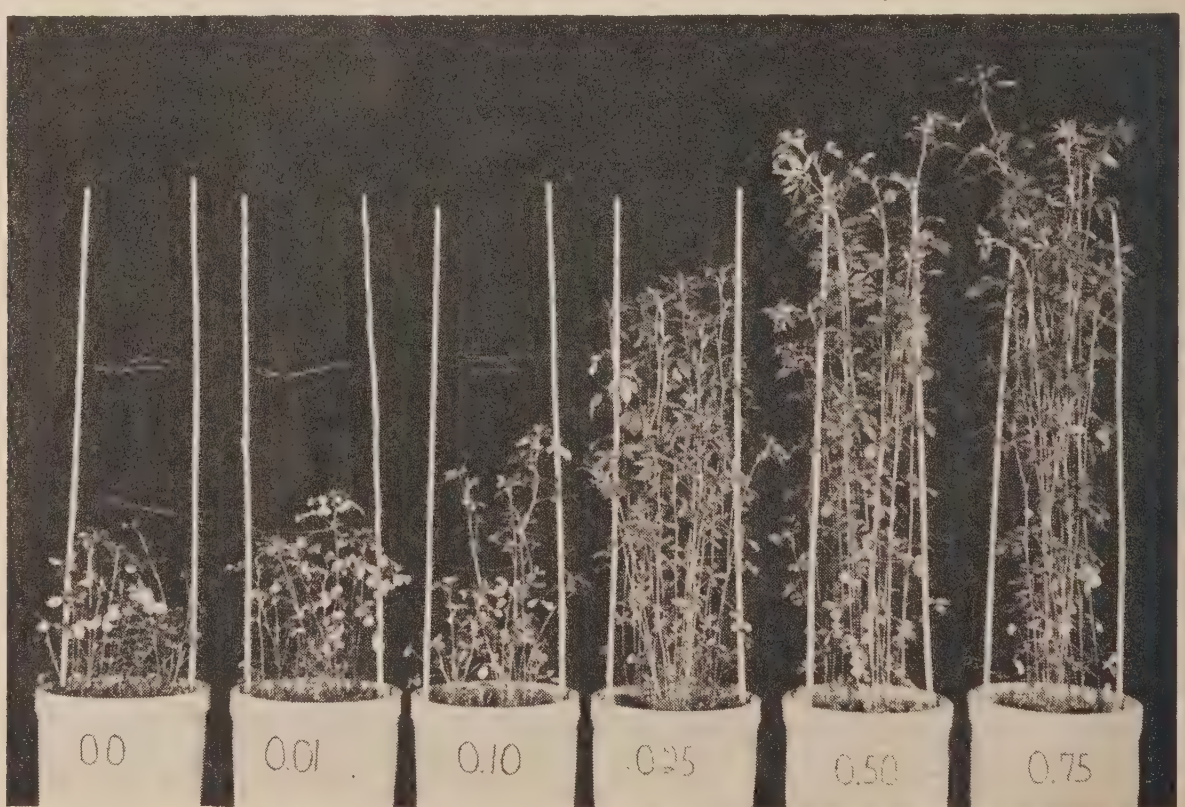



Figure 2—Alfalfa plants growing in the greenhouse; figures on the jars indicate boron concentrations in parts per million of the nutrient solutions.

Yet, no visual symptoms of boron deficiency were present other than a few dead reproductive buds, usually unnoticed by unexperienced persons. This indicates that in a case of border-line deficiency, yields of alfalfa can be reduced even if no deficiency symptoms are present. Consequently, the number of fields reported above as containing boron-deficient plants is most likely considerably lower than the number of fields where yield reductions were experienced.

***Frequency of borax applications***

From a field experiment conducted on St. Pacôme sandy loam to study the movement and accumulation of applied boron within the soil profile, it was found that approximately 85 per cent of the borax applied, regardless of the rate used, had moved below the 18-inch depth 18 months after application and below the 36-inch depth 30 months after application. Therefore, if a proper amount of boron is to be made available to alfalfa on sandy soils, it seems that borax should be applied frequently, approximately every two years, at rates ranging between 15 and 25 pounds per acre.

***Minor element status of eastern Quebec soils***

In a greenhouse study of 17 soil types of eastern Quebec, oats was found to respond to magnesium on seven, to molybdenum on two, and to copper on three (Table 10). Beneficial effects on alfalfa were also obtained with magnesium on 11 of these 17 soils, with boron on 7, molybdenum on 2, and with copper on 3. Borax at 25 pounds per acre was toxic to oats on six soils, while manganese sulphate at 40 pounds per acre was toxic to oats on four soils. The addition of manganese sulphate was toxic to alfalfa on five soils. Of the minor elements studied in the experiment, only the addition of zinc and iron had no effect on yield. Readily soluble forms were used to supply all these minor elements.

Most of the yield increases obtained with the use of minor elements occurred on coarse- and medium-textured soils. With only one fine-textured soil, De l'Anse clay loam, which has a very high content of organic matter, the yield was improved by the addition of magnesium and copper. Similarly, all cases of toxicity, except one, were observed on coarse- and medium-textured soils.

**Table 10.—Effects of additions of minor elements (soluble form) to 17 soil types of eastern Quebec on the growth of oats and alfalfa in the greenhouse.**

| Treatment lb./acre | Number of soils | | | | | |
|---|---|---|---|---|---|---|
| | Response of oats | | | Response of alfalfa | | |
| | Positive | Negative | None | Positive | Negative | None |
| 40 lb. $MnSO_4$ | 0 | 4 | 13 | 0 | 5 | 12 |
| 40 lb. $FeSO_4$ | 0 | 0 | 17 | 0 | 0 | 17 |
| 15 lb. $ZnSO_4$ | 0 | 0 | 17 | 0 | 0 | 17 |
| 10 lb. $CuSO_4$ | 3 | 0 | 14 | 3 | 0 | 14 |
| 10 lb. $(NH_4)_2MoO_4$ | 2 | 0 | 15 | 2 | 0 | 15 |
| 25 lb. borax | 0 | 6 | 11 | 7 | 0 | 10 |
| 100 lb. $MgSO_4$ | 7 | 0 | 10 | 11 | 0 | 6 |

***Liming increases the efficiency of fertilizers on acid soils***

Three-year results of fertilizer trials on De l'Anse clay loam indicate that the efficiency of phosphorus-containing fertilizers on acid soils can be increased considerably by the addition of limestone to the soil. For the period 1953-56,

the annual yield increases of mixed hay as a result of the application of 600 pounds of 2-16-6 over the non-fertilized plots were 489 pounds of dry matter without limestone, 2,216 pounds with 2 tons of limestone, 2,922 pounds with 4 tons, and 2,473 pounds with 6 tons. It was interesting to note that the interaction between these two factors, fertilizer and limestone, was negligible in cases of fertilizer formulae containing little or no phosphorus, and most pronounced in cases of formulae containing high percentages of that element. De l'Anse clay loam is a water-deposited soil found almost at sea level along the St. Lawrence river. It is very acid, poorly drained, and very high in organic matter.

***Effect of liming on legumes***

The importance of adequate liming for the successful growing of legumes and the consequent production of herbage on the acid soils of eastern Quebec is clearly shown by some of the figures obtained from 1953 to 1956 on De l'Anse clay loam (Table 11). As expected, the effect of limestone on the percentage of legumes (mainly alfalfa) in the sward was very pronounced. In fact, the percentage went from 10 in the case of unlimed plots to 40 with 6 tons of limestone. Even more interesting is the positive correlation between the yields of hay obtained over that period and the corresponding values for the percentage of legumes in the sward. Note that the soil had a pH value of 5.0 at the time of seeding.

**Table 11.—Effect of liming on the botanical composition of the sward and the yields of hay obtained on De l'Anse clay loam from 1953 to 1956.**

| Calcitic limestone tons/acre in 1952 | Percentage of legumes 4-year average | Dry matter lb./acre 4-year average |
|---|---|---|
| 0 | 10 | 2,100 |
| 2 | 31 | 3,553 |
| 4 | 36 | 3,986 |
| 6 | 40 | 4,154 |

## FORAGE CROPS

### Plant Breeding

L. Dessureaux

***A cause of the poor survival of ladino clover***

During the last few years a new disease that is especially devastating in the second year of growth has recurred on ladino clover. Extensive damage has been recorded in breeding nurseries and plant pathologists have also reported a few instances of this disease in meadows. The damage caused is important, since it is believed to be responsible for the lack of survival often noted in ladino white clover.

The disease causes a stunting of the plant and yellowing of the leaves. Roots and stolons soon decay and leaves become smaller. Flower heads often produce abnormal blossoms, and vegetative growths emerge from the corolla. The emergence of small leaves from the middle of florets has resulted in this malady being called "green petals" disease. The cause of this disease has not yet been determined, a virus is believed to be responsible.

It was noted in years of severe infestations that there was no visible evidence of the disease on certain ladino plants. A selection program is underway to determine whether this variation is hereditary. If it is found that resistance is genetically transmissible, control of the condition may be possible through improved strains.

***Improved strains of white clover for seed production***

In the last few years a number of experimental strains of ladino white clover have been synthesized. These strains were selected mainly to increase the number of seeds per pod. It was found previously that the number of seeds per pod is an important factor in seed yield. These new strains are under trial to evaluate their agronomic characteristics. So far they have been found to give higher yields of seed, but their winter hardiness is not yet satisfactory and further selection is necessary.

***Tolerance of alfalfa to acid soils***

Manganese toxicity is believed to play an important role in the detrimental effect of soil acidity on alfalfa. Chemical analyses have revealed that plants tolerant to manganese toxicity contained a higher proportion of manganese in the roots than susceptible plants. On the other hand the stems and leaves of tolerant plants had less manganese by comparison. It is logical to assume that some mechanism is responsible for the precipitation of manganese in the roots, where it is harmless.

A group of alfalfa varieties, most of them introduced from Europe, were compared in sand culture trials using normal and toxic concentrations of manganese. From the more tolerant plants a few individuals were selected and inter-crossed, and the resulting crossed progenies compared. They were more tolerant to excesses of manganese than the varieties from which they were derived and further selection and crossing were made. Results indicate that through selection it should be relatively easy to develop synthetic strains tolerant to high levels of manganese. However it remains to be determined whether there is a correlation between tolerance to manganese toxicity and tolerance to acid soils.

## Variety and Management Studies

J. E. Chevrette

***Alfalfa varieties***

Since 1951 tests of varieties of alfalfa have been conducted on the two major soil types of this Farm, Kamouraska clay and St. Andre gravelly loam. In one of these tests the alfalfas were seeded in pure stand and in mixture with timothy; in another, the varieties were given two management treatments, as hay and as pasture. The winter 1953-54 was severe enough to eliminate the less hardy varieties.

Results of these tests showed that European varities such as Du Puits and M-50 are not hardy enough to survive our winters. Of the varieties of American or Canadian origin, Rhizoma, Narragansett, Ladak, and Vernal are the most hardy and are well adapted to our conditions. Rhizoma has shown greater persistence under simulated grazing treatments than any other variety, while for hay production Narragansett is the only variety that has surpassed Rhizoma and only by a slight margin.

Ranger definitely lacks the winter hardiness required in our district. Some creeping-rooted types were also tested and although they exhibited outstanding hardiness, they were slow to recover after the first cutting and therefore cannot be recommended at present.

Figure 3—Differential ability of alfalfa varieties to resist winter killing. From left to right: Narragansett, Du Puits, Rhizoma, and Rambler. Note that Du Puits is 100 per cent killed, while the others suffered much less.

(Photo J. R. Pelletier)

***Varieties of red clover***

Previous tests have shown the superiority of the varieties Dollard and Ottawa over commercial red clover, as well as over other varieties. Under the sponsorship of the Canadian Forage Seeds Project, it was agreed to blend these two varieties to form a new one. This has been multiplied under the name of "Lasalle", since 1952. In the tests conducted since that time, Lasalle has maintained the superiority already shown by its two component varieties, as can be seen in Table 12.

**Table 12.—Yields in tons of dry matter per acre of 4 varieties of red clover for the period 1953-55.**

| | Lasalle | Redon | Kenland | Commercial |
|---|---|---|---|---|
| First cut | 2.02 | 2.24 | 1.69 | 1.70 |
| Second cut | 1.28 | 0.89 | 1.28 | 1.28 |
| TOTAL | 3.30 | 3.13 | 2.97 | 2.98 |

L.S.D. (5%) = 0.12

***Timothy varieties***

Among the several varieties of timothy tried during the period 1952-56, Climax gave the highest yield, especially when seeded in mixture with red clover according to the practice most generally followed by Quebec farmers.

***Hay and pasture mixtures***

In 1949, a test of 16 different mixtures was established on Kamouraska clay soil to determine (*a*) the comparative value of brome grass and timothy when associated with alfalfa (*b*) the effect of adding ladino or red and alsike

clover to alfalfa and (c) the extent to which bird's-foot trefoil can replace alfalfa in such mixtures. The mixtures were cut as hay the year following the year of establishment and at the first cutting in the second year. Thereafter they were clipped four times per year to simulate grazing.

Results from this test are presented in part in Table 13. The data on the relative performance of bird's-foot trefoil and alfalfa show that in short-term pastures alfalfa yields more than bird's-foot trefoil whereas in long-term pastures bird's-foot trefoil is preferable. The addition of red clover or of red clover and alsike to the alfalfa mixtures did not modify appreciably the dry-matter yields. Ladino is probably the clover species that could improve, to some extent, the productiveness of most pasture mixtures provided that very few hay crops are taken, that the management is appropriate, and that the moisture supply is adequate.

Compared with timothy, brome grass was less productive in the first two years when treated as hay, but its relative productiveness improved in the last three years when clipped as pasture. Brome grass produced more leafy growth than timothy in its aftermath. It would therefore seem advisable to add brome grass to mixtures for pasture.

***Bird's-foot trefoil as a pasture plant***

Bird's-foot trefoil has been tested at this Farm under a variety of conditions. On St. Andre gravelly loam soil, the broadleaf type was superior to the narrowleaf type.

Red fescue is one of the best grasses to grow in association with bird's-foot trefoil. Red fescue establishes itself naturally in long-term pastures in this district, and bird's-foot trefoil improves the sward considerably. The only other legume that persists under these conditions is wild white clover, and this legume is more sensitive to drought than bird's-foot trefoil.

Bird's-foot trefoil competes poorly with tall-growing species of legumes and grasses.

In short-term pastures on Kamouraska clay, a highly productive soil, bird's-foot trefoil has not produced so much as alfalfa. For long-term pastures, bird's-foot trefoil may be preferable to alfalfa because of its greater persistence. Table 13 shows that bird's-foot mixtures outyielded alfalfa mixtures beginning with the third year after seeding.

**Table 13.—Hay and pasture mixtures on Kamouraska clay—Yields in pounds of dry matter per acre.**

| Mixtures | 1950 | 1951 | 2195 | 1953 | 1954 | Average |
|---|---|---|---|---|---|---|
| Average of 3 mixtures of alfalfa | 7,394 | 6,897 | 3,502 | 2,636 | 1,302 | 4,346 |
| Average of 2 mixtures of bird's-foot trefoil | 5,218 | 4,912 | 3,871 | 3,355 | 2,534 | 3,978 |

Four varieties of bird's-foot trefoil—Empire, Viking, Granger, and Cascade —were compared in mixture with timothy or red fescue and managed as pasture. The results are summarized in Table 14. Empire had the highest yield, probably as a result of its greater winter hardiness and spreading habit of growth.

**Table 14.—Yearly dry matter production in pounds per acre of 4 varieties of bird's-foot trefoil, grown in mixture with timothy and with red fescue and managed as pasture.**

| Variety | 1954 | 1955 | 1956 | Average |
|---|---|---|---|---|
| Empire | 5,250 | 5,054 | 2,885 | 4,396 |
| Viking | 5,685 | 4,032 | 2,475 | 4,046 |
| Granger | 5,428 | 3,889 | 2,274 | 3,864 |
| Cascade | 5,774 | 3,682 | 2,343 | 3,926 |
| LSD (5%) | 117 | 143 | 219 | — |

***Long-term versus short-term pasture on Kamouraska clay soil***

A field seeded to timothy, alfalfa, and ladino clover and treated as a long-term pasture was compared with a short-term pasture seeded to two mixtures, one of timothy and ladino clover; the other of brome and alfalfa. The two types of pasture received an application of 400 lb. 4-12-6 fertilizer per acre every second year.

Results obtained over a period of five years show that the short-term pasture produced 758 lb. more dry matter per acre than the long-term pasture. The timothy-ladino clover mixture yielded 653 lb. more dry matter per acre than the brome-alfalfa mixture.

## Productiveness and Survival of Ladino Clover

J. R. Pelletier

It is generally recognized that agronomic practices in association with climatic factors affect the maximum productiveness of ladino clover, its seasonal distribution, winter survival, etc. As too little exact information was available on this particular problem, field and greenhouse experiments made of four fertility levels with three seeding mixtures (ladino alone, ladino-brome and ladino-timothy) were conducted on two major soil types of this district from 1946 to 1950. Coupled with this trial were included three cutting practices (*a*) mowing down to 1 to 2 inches when 4 to 5 inches high (*b*) when 10 to 12 inches high and (*c*) cutting down to 4 to 5 inches when 10 to 12 inches high.

The fertilizer treatments applied were the following:

F 1 High fertility with nitrogen (212 lb. of $P_2O_5$, 50 lb. of $K_2O$ at seeding time plus 50 lb. of nitrogen annually).
F 2 High fertility without nitrogen (same rates as F 1).
F 3 Medium fertility without nitrogen (half the rates of F 2).
F 4 Check.

***Field results***

The application of 1,000 pounds of 5-20-5 (F 1) at seeding time plus 50 pounds of nitogen every spring, resulted in yield increases of 158 per cent in dry matter, 139 per cent in protein, and 153 per cent in total ash. While higher soil fertility greatly affected the total yield of herbage, it failed to distribute the herbage evenly over the grazing season except when nitrogen was added. High fertility without nitrogen caused less winterkilling than the same treatment with nitrogen. The plots on Kamouraska clay outyielded those on St. Andre gravelly loam by 12 per cent.

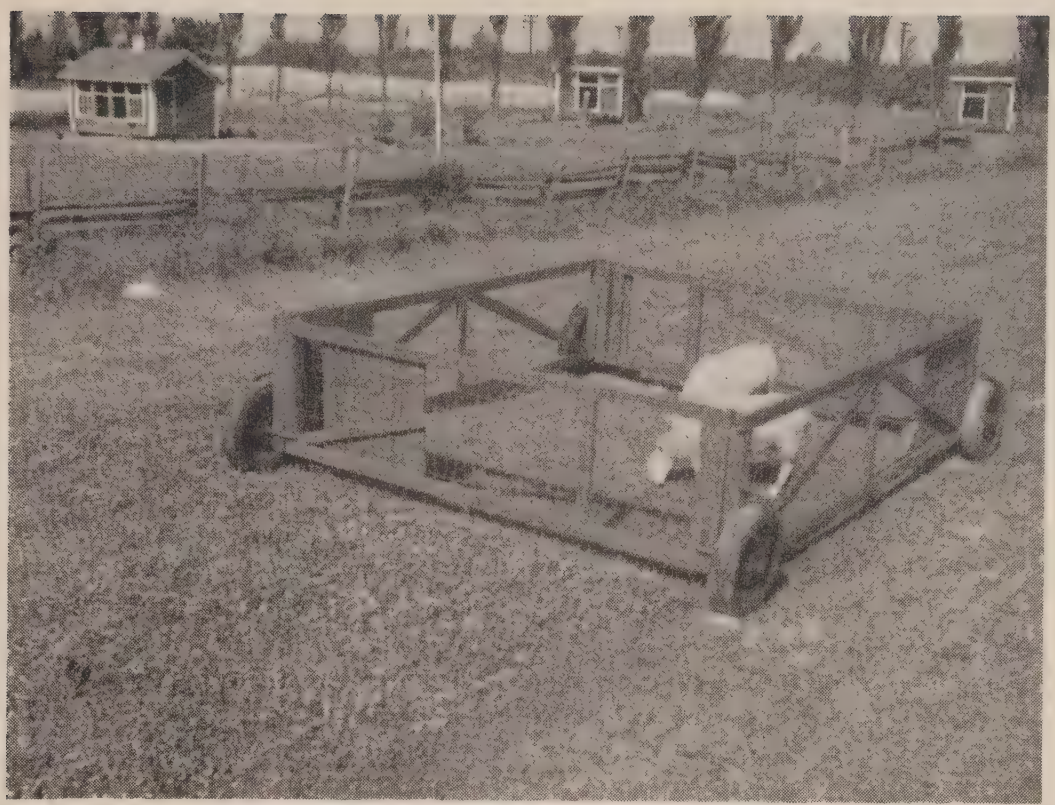


Figure 4—Experimental cage used to study the effect of grazing versus cutting.

All three seeding mixtures produced almost equal total yields of herbage during that 4-year period, but ladino, alone, gave a greater proportion of its total production the first year. The ladino–brome grass association was superior to the ladino–timothy in providing a heavier midsummer crop. In protecting ladino clover from winterkilling, timothy was more effective the first winter and brome grass the second winter. Ladino clover grown alone had a much lower survival than when associated with any of the two grasses.

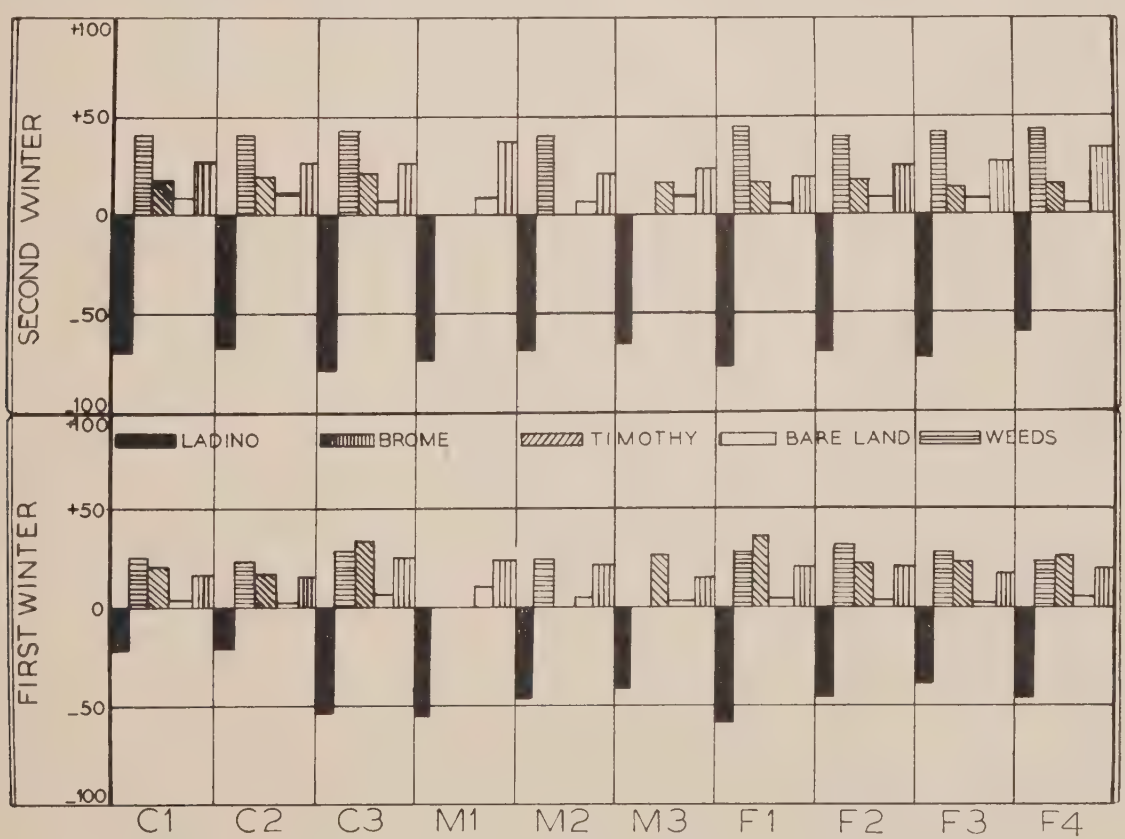



Figure 5—Fluctuations in plant populations expressed in percentages showing Ladino winterkilling as influenced by different agronomic treatments during first and second winters.

The highest yields and the most uniform distribution of herbage over the season were obtained when the plants were frequently mowed down to 1 to 2 inches after reaching 4 to 5 inches in height. None of the cutting methods studied was better than the others in ensuring the survival of ladino clover, although the 4- to 5-inch stubble held the snow longer in the spring, which is advantageous in preventing ice sheets that often kill the clover plants. Mortality was generally higher the second winter, either because the plants were older or because food supply was less plentiful following two heavy production seasons.

Swards of ladino plants exposed to temperatures of −2°F, even for only 4 hours, were almost completely killed. In a second cold test, at 18°F for 10 hours, nearly all ladino rhizomes were again seriously damaged even when associated with grasses. Grazing sheep killed more ladino rhizomes than did frequent mowing at 2 inches in height. Among swards receiving the same agronomic treatments those with younger plants survived best. No significant difference was found in the total carbohydrates stored in ladino roots from swards that had received different agronomic treatments, even those of the highest fertility level.

Figure 6—Left: Method of collecting representative swards for the freezing test. Right: Samples of young and old Ladino plants undergoing freezing test.

***Greenhouse results***

As the objectives were approximately the same in the greenhouse as in field studies the same experimental outline was followed. The findings are summarized below.

The highest level of fertility gave considerably larger top growth than the lowest, but the accumulation of root tissues was about the same; thus making the top:root ratio much narrower in the lowest fertility group. Under all agronomic treatments (fertility levels, seeding mixtures, cutting methods) ladino alone and ladino with timothy averaged about equal in top growth, while ladino with brome grass produced considerably less, and therefore had a much narrower top:root ratio. Again a narrower top:root ratio was obtained when fewer cuttings were made at greater height, than in the case of more frequent cuttings at lower height.

Yields generally decreased proportionately with the fertility levels, yet the differences observed under greenhouse conditions were far less striking than those observed in field trials. On the other hand, the effect of cuttings was considerably more noticeable under greenhouse conditions. Ladino plants grown in the greenhouse exhibited far greater susceptibility to cold than those grown in the field under the same agronomic treatments. Ladino plants grown with grasses were not so readily killed as those grown in pure swards.

# CEREAL CROPS

F. M. Gauthier

Cereal work was increased greatly during the period under review. Breeding programs on oats and barley were initiated in 1956 to develop superior varieties for the Lower St. Lawrence Valley and other areas in Quebec. The testing program at the Farm, as well as at outside points, was expanded in an effort to determine the regional adaptation of superior varieties. The production of pure seed of superior varieties is an important part of the program. Special studies have been undertaken, in co-operation with the Cereal Crops Division, Ottawa, to develop lines and parental stocks with resistance to lodging and diseases.

The objectives are to develop superior varieties of oats and barley with high yields, early maturity, and resistance to lodging and disease. In the oat breeding program, special emphasis is placed on breeding for resistance to Septoria leaf blotch. Losses due to this disease have increased steadily during the past few years. The objective in the barley breeding program is the development of varieties with adaptation to poorly drained soils, acid tolerance, and complete smut resistance.

It is the policy of this Farm to produce and maintain limited quantities of high quality seed for distribution to local producers. Seed stocks of the oat variety Erban have been produced at the Farm for several years. Erban is now being replaced by Abegweit, a better yielding variety having greater resistance to disease. Lately, Garry and Shefford have been multiplied on a small scale, the first for its outstanding disease resistance and the second for its earliness and quality.

### *Spring wheat*

Many varieties were tested to discover those satisfactory for growing in mixture with early oats. Saunders, Redman and, more recently, Selkirk were compared with standard varieties but all gave inferior yields. Cascade, a medium late, beardless, soft, white wheat, is still the best yielder and is propagated to supply the demand for seed. The variety Acadia, although slightly less productive, is often chosen for its short straw, bearded heads, and semi-hard red kernels.

### *Winter wheat*

Winter wheat has been grown successfully for years on this Farm. It is a very productive crop, and among its desirable features is the fact that it usually matures before the summer drought. The two essentials to success with winter wheat are a well-drained soil, to prevent an ice sheet, and a winter-hardy variety.

Kharkov 22 M.C. and Yogo are the most winter-hardy varieties. Kharkov 22 M.C. is recommended for this area and is propagated to supply the demand for seed. Under ideal wintering conditions, Rideau is more productive and a better producer of forage in the fall.

### *Oats*

A large number of varieties and strains were tested during the 5-year period to find high yielding varieties with greater straw strength and disease resistance. Special attention was paid to early maturity.

Comparative data collected at Ste. Anne de la Pocatiere on the most promising varieties are summarized in Table 15. Abegweit was the most productive variety on the Farm and outside tests on various soil types have confirmed its wide adaptability. Abegweit possesses several desirable features

that make it an outstanding variety but it matures too late in a large part of this district. Efforts were made to select earlier productive varieties. One of these, Shefford, has good agronomic characters and is preferred to Simcoe because of its better straw strength and superior quality. Shefford is gradually replacing Ajax in the Lower St. Lawrence Valley. A new variety, Glen, developed at Macdonald College, has produced excellent yields; it has a large kernel and possesses other desirable features. Fundy is another promising early variety. It is recommended in the Maritimes but more testing is necessary before it can be recommended here. Shield is a very early variety with excellent disease resistance but has not performed too well when seeded late.

**Table 15.—Average yield per acre and maturity of oat varieties grown at Ste. Anne de la Pocatiere, on Kamouraska clay soil, 1953-56.**

| Variety | Maturity | 1953–56 4 years | 1954–56 3 years |
|---|---|---|---|
| Abegweit | Medium late | 86.0 | 75.2 |
| Glen | Early | 83.2 | 74 5 |
| Simcoe | Early | 81.4 | 68.3 |
| Ajax | Early | 75.4 | 68.0 |
| Shefford | Early | 75.2 | 68.3 |
| Garry | Medium early | | 71.0 |
| Fundy | Very early | | 69.9 |
| Victory | Late | | 67.8 |
| Rodney | Medium late | | 66.2 |
| Shield | Very early | | 64.1 |

Two new varieties, Garry and Rodney, are outstanding for their excellent disease resistance. Although Rodney has a very attractive kernel, Garry is preferred in the district for its earlier maturity, strong straw, higher yields, and moderate resistance to speckled leaf blotch.

Victory was included in these tests as a long-term check variety. Despite the fact that Victory was favored in 1956 by freedom from diseases, it produced lower yields than most of the improved varieties during the 3-year period 1954-56. Considering that it is a late maturing variety, susceptible to many diseases and only fair in lodging resistance and grain quality, it seems safe to conclude that the more recently developed varieties represent a great improvement over the older ones.

***Barley***

The increase of the barley acreage in this province is a long-time objective. One of the best means to achieve this is to offer high yielding varieties having a wide adaptation. Many varieties were tested during the period under review, among them Husky, Wolfe, Vantmore, and Swan and several two-rowed barleys. None of these was satisfactory.

Results obtained with the most promising varieties are summarized in Table 16. Montcalm is still the most popular variety; it is preferred to O.A.C. 21 because it has smooth awns. The new variety Brant, not acceptable for malting, has been productive at Ste Anne and also in outside tests, but it has a short and weak straw. Nord is a very early variety with short straw; it could be useful where the growing season is short. More testing is necessary before

recommending it. Parkland, a malting variety released in 1957, has been tested for only two years in this area, but it seems promising. It has smooth awns and strong straw. Fort, a feed variety is the lowest yielder in the group, but is preferred in some areas because of its resistance to lodging.

**Table 16.—Average yield per acre in bushels and resistance to lodging of barley varieties grown at Ste. Anne de la Pocatiere, on Kamouraska clay soil, 1952-56.**

| Variety | Resistance to lodging | 1952–56 5 years | 1955–56 2 years |
|---|---|---|---|
| Brant | Poor | 59.1 | 52.0 |
| Montcalm | Fair | 57.0 | 46.3 |
| O.A.C. 21 | Fair | 54.7 | 46.6 |
| Fort | Very good | 50.2 | 42.8 |
| Nord | Good | | 44.4 |
| Parkland | Good | | 43.3 |

***Field peas***

Field peas are well adapted to our conditions and produce excellent yields. A larger acreage could be devoted to this crop considering the strong demand for good cooking peas and their value as a high protein feed.

The choice of varieties varies according to the needs. Valley is the best yielder with Arthur a good second. Both produce yellow seeds of medium size. Small quantities of Valley are propagated annually for seed. Chancellor is lower yielding but it is often preferred because of its small seeds. Several new promising strains are being tested. Emphasis is placed on disease resistance and yield.

***Field beans***

The choice of field bean varieties is made largely on the basis of seed size, smaller seed being preferred. However, early maturity should also be taken into consideration. The variety Michelite has been a long-time favorite because of its small seed, but it is a low yielder and is late maturing. Navy is productive but it has very large seed and is late maturing. Burbank is an early variety with medium seed size and is an excellent yielder. Clipper, Grainer, and Monroe are intermediate in maturity and seed size.

## HORTICULTURE

### B. Forest

Research was carried on to test new varieties and selected seedlings of tree fruits, and to study methods of grafting apple trees and other general fruit problems. Variety trials of small fruits have also been conducted, and virus-free strawberry plants have been propagated for distribution. Vegetable varieties of several species have been tested each year to determine their adaptation to the conditions of the Lower St. Lawrence and their value for breeding purposes. The influence of variety, stage of maturity, partial shading, and mineral nutrition on the acidity of rhubarb petioles has been studied. In addition, an extensive collection of ornamental trees and shrubs is being maintained for the beautification of the grounds and to provide information on hardiness.

*Apple varieties*

The testing of newly introduced varieties and selected seedlings of apples constitutes a large part of the fruit work. Improved early types are needed and much attention has been given to several Ottawa selections that ripen earlier than Melba. Five of these fruited during the last five years and could be evaluated.

The 0-272, 0-274, 0-275, 0-276, and 0-277 seedlings have shown considerable promise. 0-276 is the earliest to ripen and is fully equal to Crimson Beauty in early maturity. The average picking date for Crimson Beauty is August 20 while Melba is harvested around September 7. 0-272, 0-274, 0-275, and 0-277 ripen a week earlier than Melba. All of these seedlings with the exception of 0-272, which has superior color, resemble Melba in appearance. They are superior to Crimson Beauty in eating quality. The trees are vigorous but their hardiness has not yet been fully evaluated.

The commercial varieties recommended are: Melba, Hume, Lobo, McIntosh, Cortland, and Bancroft.

*Frameworking mature apple trees*

In 1948 a project was undertaken to compare the value of frameworking and topworking mature apple trees. The trees frameworked to McIntosh are now giving normal production and satisfactory results have been obtained with trees frameworked to Niobe and Sandow. Trees topworked to these varieties have not yet returned to normal production and some of them are in poor condition because of broken branches.

Yields are shown in Table 17. The performance of frameworked trees suggests that the higher cost of this method of grafting apple trees is justifiable. It produces better trees that return more quickly to normal production.

**Table 17.—Yields of McIntosh, Niobe, and Sandow varieties worked on Charlamoff trees.**

| Variety | Method of grafting | Year grafted | No. of trees | Yield in 1956 | Cumulative yield to 1956 |
|---|---|---|---|---|---|
| | | | | bu./tree | bu./tree |
| McIntosh | Frameworking | 1949 | 2 | 13.12 | 44.75 |
| | Topworking | 1949 | 2 | 7.00 | 19.00 |
| Niobe | Frameworking | 1948 | 2 | 9.00 | 35.50 |
| | Topworking | 1948 | 2 | 3.87 | 11.62 |
| Sandow | Frameworking | 1948 | 2 | 3.87 | 29.50 |
| | Topworking | 1948 | 2 | 0.62 | 5.00 |

*Pears*

The pear varieties, Clapps Favorite, Bartlett, and Flemish Beauty have continued to be dependable under local conditions. Three Ottawa varieties, Enie, Menie, and Miney, have performed fairly satisfactorily and are recommended. Enie ripens early in September and Miney is ready about the middle of September, a week earlier than Clapps Favorite. Menie ripens around October 10. Miney has the best dessert quality followed by Menie and Enie. These varieties are inferior to Clapps Favorite in quality. The trees are vigorous, good yielders, and appear to be hardy.

***Strawberries***

All the strawberry varieties that were carried prior to 1955 were discarded because of virus infection. In 1956 a new trial was set up with virus-free plants of the Ottawa seedlings 0-481, 0-483, 0-484, 0-487, and Senator Dunlap and Sparkle. Variety recommendations are withheld following the results of these variety trials. Senator Dunlap, which is the most important commercial variety grown in our region, is still recommended but growers should plant virus-free stocks.

A program was instituted in 1956 to propagate and maintain in a virus-free condition strawberry plants of varieties that are most important in our region. These plants will serve as a source of certified plants from which local growers can obtain a nucleus of healthy stock for their own propagation.

***Vegetables***

Several varieties, hybrids, or strains of vegetables have been tested to determine their performance under local conditions and their possible value in the development of improved varieties. Increased earliness to enable crops to mature in our short-season district is particularly important. Yield and quality are also important features in vegetable varieties, especially in those designed for market or home gardens.. Table 18 covers vegetable crops that have been tested over a number of years. A varietal list of vegetables that can be grown under local conditions is revised annually and is available on request.

**Table 18.—Vegetable varieties for the Ste. Anne de la Pocatiere region**

| Vegetable | Varieties | Days to maturity | Yield in lb. per 30-foot row | Remarks |
|---|---|---|---|---|
| Beans | Contender | 58 | 22.3 | Green pods; quality |
| | Topcrop | 59 | 17.3 | Green pods; attractive |
| | Unrivalled Wax | 55 | 21.6 | Early; productive |
| | Cherokee | 56 | 16.8 | Pods golden wax |
| Beets | Dark Red | 65 | 22.7 | Very good strain |
| | Bonne pour tout | 60 | 21.5 | Earliness |
| Cabbage | Golden Acre Viking | 93 | 36.0 | Early round headed |
| | Viking Small Early | 94 | 32.7 | Plants and heads small |
| | Succession | 111 | 40.7 | Midseason |
| | Danish Ballhead | Late | 48.2 | Standard late variety |
| | Ottawa CA-1 | Late | 48.0 | Heads uniform |
| Carrots | Nantaise | 70 | 20.9 | Early; high quality |
| | Gold Spike | 74 | 27.3 | Bunching-type |
| | Marché Français | 76 | 21.7 | High quality; uniform |
| Cauliflower | Snowball X | 99 | 12.0 | Large solid heads |
| | Danish Giant | 92 | 10.1 | Early variety |
| Corn | Spancross | 75 | 22.4 | Excellent first early |
| | Earligold | 79 | 24.0 | Early; quality good |
| | Carmelcross | 83 | 33.8 | Heavy yielding |
| | Seneca Arrow | 87 | 29.1 | Late; quality excellent |

**Table 18.—Vegetable varieties for the Ste. Anne de la Pocatiere region**—(Cont'd)

| Vegetable | Varieties | Days to maturity | Yield in lb. per 30-foot row | Remarks |
|---|---|---|---|---|
| Lettuce | Penn Lake | 66 | 24.8 | Heads solid large |
| | Premier Great Lakes | 66 | 23.5 | Heads solid round |
| Onions | Early Yellow Globe | 145 | 31.2 | Good size and yield |
| | Autumn Spice | 145 | 23.0 | Uniform and attractive |
| Peas | Little Marvel | 52 | 7.9 | First early garden type |
| | Director | 58 | 9.9 | Productive, 4-inch pods |
| | Alderman | 62 | 7.4 | Long pods; quality |
| Tomatoes | Chatham | 116 | 70.9 | First early variety |
| | Monarch | 119 | 77.7 | Large, rounded fruit |
| | Quebec 5 | 121 | 80.2 | Fruit medium size |
| | Bounty | 128 | 80.1 | Productive; globe shaped |

***Potato seedling and variety tests***

Potato testing is carried on to appraise, under local conditions, the seedlings originated in the potato breeding program of the Fredericton Experimental Farm, N.B., or other institutions. Keswick, resistant to certain strains of late blight, is now grown extensively in the region. Huron, recently licenced, has performed very well in a 2-year test. It is resistant to scab and is a high-yielding, very late maturing variety. Green Mountain, a good yielder under our conditions, is still the main variety grown in this area.

***Acidity of rhubarb***

Field experiments were conducted to determine the effect of stage of maturity and season on the acidity of rhubarb petioles. Acidity changes with age of petioles were determined as well as changes in petioles of similar age developed at different periods of the growing season. The results of the chemical analyses of rhubarb petioles are presented in Table 19.

**Table 19.—Acidity changes of rhubarb petioles**

| Acidity | Age in days | | | | L.S.D. | Sampling date | | | | L.S.D. |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 20 | 30 | 40 | P=.05 | May 24 | June 3 | June 13 | June 23 | P=.05 |
| pH | 3.1 | 3.2 | 3.3 | 3.4 | 0.1 | 3.5 | 3.2 | 3.1 | 3.2 | 0.09 |
| Titratable acidity as malic acid gm./100 ml | 1.65 | 1.73 | 1.71 | 1.22 | 0.36 | 1.30 | 1.62 | 1.79 | 1.69 | 0.06 |

The pH increased very significantly with age. The younger petioles were more acid than the older ones. The titratable acidity of the petioles remained constant or increased slightly until the petioles were from 20 to 30 days old and decreased rapidly thereafter. The soluble potassium content of the petioles increased also very markedly with age. The amount of soluble potassium present in the 40-day-old petioles was for some samples almost double that of the 10-day petioles.

The pH of rhubarb petioles was rather high early in the season but it declined during the season and increased slightly at the last sampling date. This is interpreted as indicating that the acidity of the petioles increased with the season, which is also shown by titratable acidity changes. Early in the season, the titratable acidity was low but it was significantly higher at the end of the harvest season. The differences in soluble potassium content between petioles of the same age at different dates during the season were not significant.

Differences in titratable acidity between five rhubarb varieties were significant. Valentine had the lowest acidity expressed as malic acid and Macdonald had the highest acidity.

## APICULTURE

B. Forest

During the 5-year period (1952 to 1956) covered in this report, an average of 55 colonies of Italian bees have been kept for experimental purposes and demonstration work. Projects on wintering, toxicity of orchard sprays, and hybrid queen stock testing have been active.

### *Study of honey flows*

A colony was kept on scales and the daily gain or loss was recorded during the active period of honey gathering to study the time and length of the honey-flow. The average gain was 45.2 lb. in June, 128.7 lb. in July, and 13.4 lb. in August. The average loss was 2.1 lb. in May and 13.1 lb. in September.

The stores used during the rest period were 28.7 pounds of honey per colony.

The yearly average crop of honey produced per colony was 114 pounds of honey during the last five years.

### *Wintering bees*

Two-colony and four-colony cases have been used in outside wintering tests. Four inches of dry planer shavings were used for packing underneath the hives and between the hives and the case, with a tunnel through the packing to connect the entrance of the hive with the flight-hole of the case. The top packing consisted of 10 inches of shavings, and a waterproof cover.

Colonies were also wintered in a cellar. The average temperature of the cellar was 51° F, and the average length of the wintering period was 143 days. It is generally accepted that the optimum temperature range is from 40 to 45 degrees. The amount of feed consumed during the winter averaged 20 pounds per colony wintered in the cellar. The results of the wintering methods during the 5-year period are given in Table 20.

**Table 20.—Comparison of wintering methods**

| Method | Number of colonies | Colonies dead in spring | | Surviving weak colonies | | Surviving strong colonies | |
|---|---|---|---|---|---|---|---|
| | | Number | % | Number | % | Number | % |
| 4-colony cases..... | 48 | 5 | 10.4 | 7 | 14.6 | 36 | 75.0 |
| 2-colony cases..... | 137 | 15 | 10.9 | 15 | 11.0 | 107 | 78.1 |
| In a cellar..... | 70 | 9 | 12.9 | 11 | 15.7 | 50 | 71.4 |

The success of each wintering method was measured by the condition of the colonies the following spring and not by the crops produced because several other factors affect the producing ability of the colony once the active season opens. On this basis, outdoor wintering, particularly in two-colony cases, gave better results than wintering in the cellar.

***Toxicity of orchard sprays to honeybees***

Field tests were conducted with dieldrin in 1955 and 1956 in fruit orchards of the Farm to determine the toxicity of this insecticide to honeybees under field conditions. Ten colonies, equipped with specially constructed cages for trapping sick and dying bees, were used. Dieldrin was used at the rate of 10 ounces of 50 per cent wettable powder per hundred gallons of water with glyodin as a fungicide for both pink and calyx sprays.

**Table 21.—Dead bees collected from ten colonies during a 3-day period before and after spraying.**

| | Partial Bloom Stage (Pink) | | Calyx | |
|---|---|---|---|---|
| | Pre-spray | Post-spray | Pre-spray | Post-spray |
| 1955 | 608 | 2,020 | 278 | 5,731 |
| 1956 | 170 | 2,286 | 194 | 1,645 |

It is obvious from the data presented in the above table that a significant increase in dead bees occurred following the application of the spray material. The highest mortality for one colony was 1,600 bees the day following calyx spray in 1955.

Five samples of 50 bees each were collected from trees sprayed with Dieldrin and five samples from trees in a check orchard that had not been sprayed with dieldrin. These bees were kept in small cages in a warm room and supplied with a 60 per cent sugar solution.

**Table 22.—Average cumulative mortality (in percentages) of bees collected from apple bloom and held in the laboratory in 1956.**

| Days after collection | Unsprayed trees | | Sprayed trees | |
|---|---|---|---|---|
| | Partial bloom stage | Calyx stage | Partial bloom stage | Calyx stage |
| 1 | 2 | 4 | 52 | 56 |
| 2 | 10 | 12 | 92 | 88 |
| 3 | 18 | 18 | 100 | 100 |
| 10 | 84 | 86 | ..... | ..... |

All the bees collected from bloom that had been sprayed were dead at the end of three days while only 18 per cent of the bees taken from unsprayed trees died during this period.

From these results it is evident that an increase in mortality occurred following application of spray containing dieldrin. The conclusions are that serious poisoning of bees may be expected in orchards where dieldrin is applied during the blooming period.

***Hybrid queen stock testing***

A test of hybrid queens from different strains has been under way since 1953. Thirty-eight queens from four hybrid strains were compared with an equal number of commercial queens. The queens were introduced to colonies

the previous fall and overwintered. In 1954, one hybrid strain produced an average of 163 pounds of honey per colony compared with 188 pounds for the commercial strain. In 1955, the average production for both strains was 146 pounds. In 1956, one hybrid line produced 19 pounds less honey per colony than the commercial stock, while another hybrid line produced an average of 40 pounds less than the commercial strain. The results indicate that the hybrid queen stocks tested were inferior in production to strains from commercial queens.

## ANIMAL HUSBANDRY

J. P. LEMAY

### Dairy Cattle

***Performance of Ayrshire herd***

The 5-year average production for the Ayrshire herd under R.O.P. regulations was 9,984.0 pounds of milk at 4.3 per cent butterfat for 94 official lactation. In 1956 the average type classification score for 36 milch cows was 86 per cent.

***Roughages and meal combinations in milk production***

A 3-year feeding trial was initiated in the fall of 1952 to (1) measure the economical and physical limits of replacing concentrates in milk production and (2) evaluate the extent to which the amount of roughages could be increased in replacement of grain supplement for dairy cows without affecting production efficiency. Twelve Ayrshire cows were used in a double switch-back design to compare the following rations:

A—Grass silage and hay ad libitum plus 1 pound of meal per 4 pounds of 4 per cent milk.
B—Grass silage and hay ad libitum plus 1 pound of meal per 6 pounds of 4 per cent milk.
C—Grass silage and hay ad libitum.
D—One pound of hay and 4 pounds of grass silage per 100 pounds of body weight.

**Table 23.—Three-year results with roughages and meal combinations in producing milk.**

| Items | Rations | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Average daily production of 4% milk per cow.....lb. | 25.5 | 24.1 | 19.8 | 19.2 |
| Total T.D.N. consumed.....lb. | 754.6 | 702.7 | 581.0 | 479.8 |
| Total T.D.N. required for maintenance and milk..lb. | 748.7 | 719.9 | 603.1 | 591.8 |
| Body weight loss or gain.....lb. | +0.40 | +0.28 | −0.17 | −0.18 |
| Feed cost per 100 pounds 4% milk.....$ | 1.73 | 1.55 | 1.19 | 1.09 |

The experiment showed that:

(*a*) There was no significant difference in average daily milk yield, butterfat content, and body weight between the groups receiving 1 pound of grain for every 4 pounds of milk and 1 pound of grain for every 6 pounds of milk.

(*b*) Roughages ad libitum, without concentrates, resulted in less milk than when concentrates were fed, and in decreased body weight.

(*c*) The two groups of cattle receiving roughages ad libitum, but no concentrates, came out of this trial in a weak condition.

***Breeding polled Ayrshires***

In 1950, a project was undertaken to develop a herd of high-producing polled Ayrshires. Two polled Ayrshire bulls "Clover Crest New Design"—x 383500 and "Greenrange Nipper"—x 90683 were mated to horned Ayrshire cows. The progeny and succeeding generations will be used in an effort to produce a true-breeding polled herd.

## Sheep

***Crossbreeding studies with sheep***

Crossbreeding was compared with purebreeding in the production of market lambs. Such factors as vigor, rapidity of growth, early market finish, and carcass grade of lambs as well as vigor, size, fertility, and prolificacy of ewes were compared.

Purebred Leicester and Cheviot flocks were maintained, and reciprocal crosses of the two breeds were made to obtain cross-bred females for further crossing with a black-faced breed. The purebred and cross-bred flocks were handled as one flock and all lambs were raised under identical conditions.

Results showed that the carcass grade of cross-bred lambs was superior to that of the purebreds. For a 9-year period, cross-bred lambs surpassed the purebreds of either breed by 0.6 pound at birth, by 0.5 pounds at 4 weeks of age and by 2.0 pounds at weaning time. Furthermore, a higher percentage of twins was obtained from the cross-breds than with purebreds. Easier lambing resulted when the purebred Cheviot ram was bred to Leicester ewes than when the reciprocal cross was made.

Figure 7—A representative sample of double-cross yearling ewes (Leicester X N. Cheviot ewes X Suffolk ram).

## Swine

***Significance of Advanced Registry records***

The purpose of this project was to (*a*) evaluate the carcass quality of market pigs born from the mating of high × high versus high × low versus low ×high versus low × low and (b) study the heritability of economic characters of bacon hogs as measured under the Advanced Registry plan.

In this project, boars and gilts were selected from high-testing litters (carcass scores over 80 per cent), and from low-testing litters (carcass scores under 70 per cent). From each litter tested, four pigs (2 barrows and 2 gilts) were selected at weaning age for feed and carcass tests. All tested groups were fed the same Advanced Registry rations. An analysis of the data revealed that the progeny of the high × high groups averaged 72.0 per cent in carcass score, the high × low 66.3 per cent, the low × high 61.3 per cent, and the low × low 52.4 per cent.

***Aureomycin in the ration of pigs***

The objects of this experiment were (1) to find out whether creep feeding with and without aureomycin would reduce mortality and maintain better health of pigs during full nursing time and (2) to measure the effect of aureomycin in the growing-fattening ration on the rate of gain from weaning to market age and on carcass score.

Three-year results show that creep feeding with aureomycin gave higher mean daily gains from two weeks on, with heavier pigs at weaning. Pigs receiving rations with aureomycin had a slightly better feed utilization from weaning to market, but the difference was far less pronounced than during the nursing period. There was no difference in carcass grades.

## POULTRY

J. A. Lemay

***Breeding for breast conformation in laying strains of chickens***

The purpose of this experiment was to investigate the possibility of improving breast conformation of chickens by selection, and at the same time attempt to maintain existing levels of egg production.

The two lines of Barred Plymouth Rock birds used in this project were formed from the same laying strain. One line, hereafter called the "control" line, was selected for characters concerned with improvement in total egg production, such as level of production and viability. The other line, to be indicated as the "broad-breasted" line, was selected for breast conformation only. The criterion of breast conformation was breast width adjusted for differences in body depth, according to the method of Bird (Poultry Science 27:506-508, 1948).

Data have been obtained from six generations. The breeding population in each generation for the broad-breasted line averaged 4.5 sires and 44.0 dams, with a range of 3 to 5 sires and 20 to 60 dams. The number of control line breeders varied from 4 to 5 sires, with an average of 4.5, and 48 to 62 dams, averaging 54.8. All breeding was on a pedigree basis.

The birds were measured for breast conformation at 25 weeks of age. In the first generation the means of breast width of the males were 53.8 mm. in the control line and 52.2 mm. in the broad-breasted line. Fertility of the selected breeders was 91.2 per cent in the control line and 90.8 per cent in the broad-breasted line, while the percentage of total eggs hatched in the two lines was, respectively, 83.4 and 82.8. The average yearly egg production per bird was 235.3 in the control line and 233.9 for the broad-breasted line. Thus at the start of the experiment, the two lines were very similar. Comparative data for the two lines are shown in Table 24.

**Table 24.—Mean body depth, width of breast, fertility and egg production of two lines during six generations of selection.**

| Generation | Males | | | Females | | | Fertility % | Survivor egg production no. |
|---|---|---|---|---|---|---|---|---|
| | No. measured | Body depth mm. | Breast width mm. | No. measured | Body depth mm. | Breast width mm. | | |
| **Broad-Breasted Line** | | | | | | | | |
| 1 | 65 | 140.2 | 52.2 | ..... | ..... | ..... | 90.8 | 233.9 |
| 2 | 29 | 132.5 | 54.0 | 56 | 115.6 | 53.3 | 84.3 | 212.4 |
| 3 | 75 | 133.6 | 57.5 | 94 | 113.0 | 56.0 | 78.0 | 211.2 |
| 4 | 103 | 132.5 | 57.6 | 168 | 117.1 | 59.0 | 71.7 | 214.2 |
| 5 | 149 | 136.0 | 55.5 | 222 | 119.1 | 56.2 | 69.3 | 198.7 |
| 6 | 142 | 134.3 | 57.0 | 205 | 117.4 | 58.3 | 66.7 | 207.8 |
| **Control Line** | | | | | | | | |
| 1 | 77 | 143.9 | 53.8 | ..... | ..... | ..... | 91.2 | 235.3 |
| 2 | 54 | 138.2 | 51.2 | 161 | 119.3 | 52.0 | 88.0 | 242.9 |
| 3 | 42 | 139.0 | 54.7 | 211 | 121.8 | 52.8 | 88.5 | 246.7 |
| 4 | 122 | 137.3 | 51.8 | 282 | 121.3 | 52.4 | 88.9 | 237.0 |
| 5 | 116 | 138.7 | 48.2 | 217 | 123.5 | 49.8 | 85.6 | 230.5 |
| 6 | 172 | 140.2 | 50.1 | 242 | 122.5 | 48.4 | 83.8 | 236.6 |

After six generations of selection, an appreciable increase in the breast width of the broad-breasted line had occurred, whereas the breast width of the control line had declined. The mean width of breast of the broad-breasted line was 57.0 mm. for the males and 58.3 mm. for the females as against 50.1 mm. and 48.4 mm. for the males and females, respectively, in the stock selected for egg production. Accompanying the increased breast width in the broad-breasted line was a decrease in body depth. Furthermore, fertility and egg production decreased with each generation as birds were improved for breast conformation. The fertility of the broad-breasted line was as low as 66.7 per cent in comparison with 83.9 per cent in the control line. The percentage of total eggs hatched was 54.4 for the broad-breasted line and 71.4 for the control line. The average egg production per bird was 207.8 in the line selected for breast conformation, and 236.6 in the other. The data on fertile eggs hatched, mortality, egg and body weights showed no difference between the two lines. In Table 24, all body measurements are of random samples of the birds in each generation, as are the data on egg production; the fertility data are for the selected breeders.

The results of this experiment indicate that a negative genetic relationship exists between width of breast and egg production in chickens; if one trait is increased by selection, a corresponding decrease in the other can be expected. Consequently, it would seem to be difficult to introduce the broad-breasted character into a strain of chickens and maintain a high level of egg production at the same time.

***Ventilation of poultry houses***

Excellent results have been obtained with a fan ventilation system by causing the animal heat to be circulated down to litter level thus keeping the litter dry, particularly during cold and wet days.

The fan used had the capacity to change air at the rate of one cubic foot per minute per pound of live weight. It was installed in the center of the pen, near the ceiling but about five feet away from the front wall. The air outlet in the front wall had the same dimensions as the fan propeller and was supplied on the inside with a vertically sliding trap. Adjacent front windows served as air inlets.

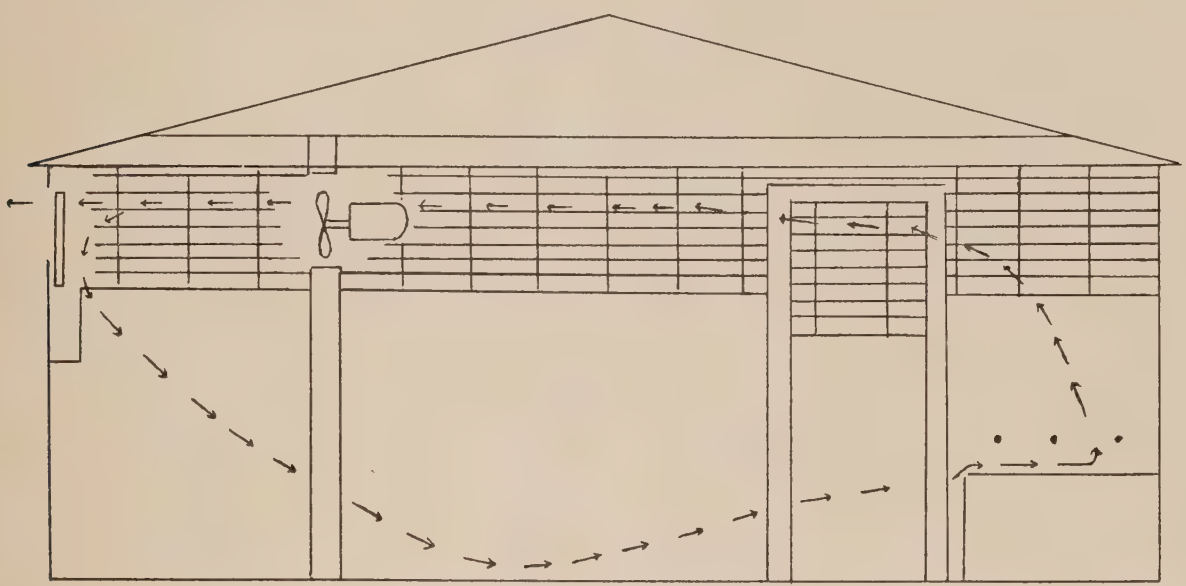


Figure 8—Diagram illustrating position of fan, outlet, and course of air movement.

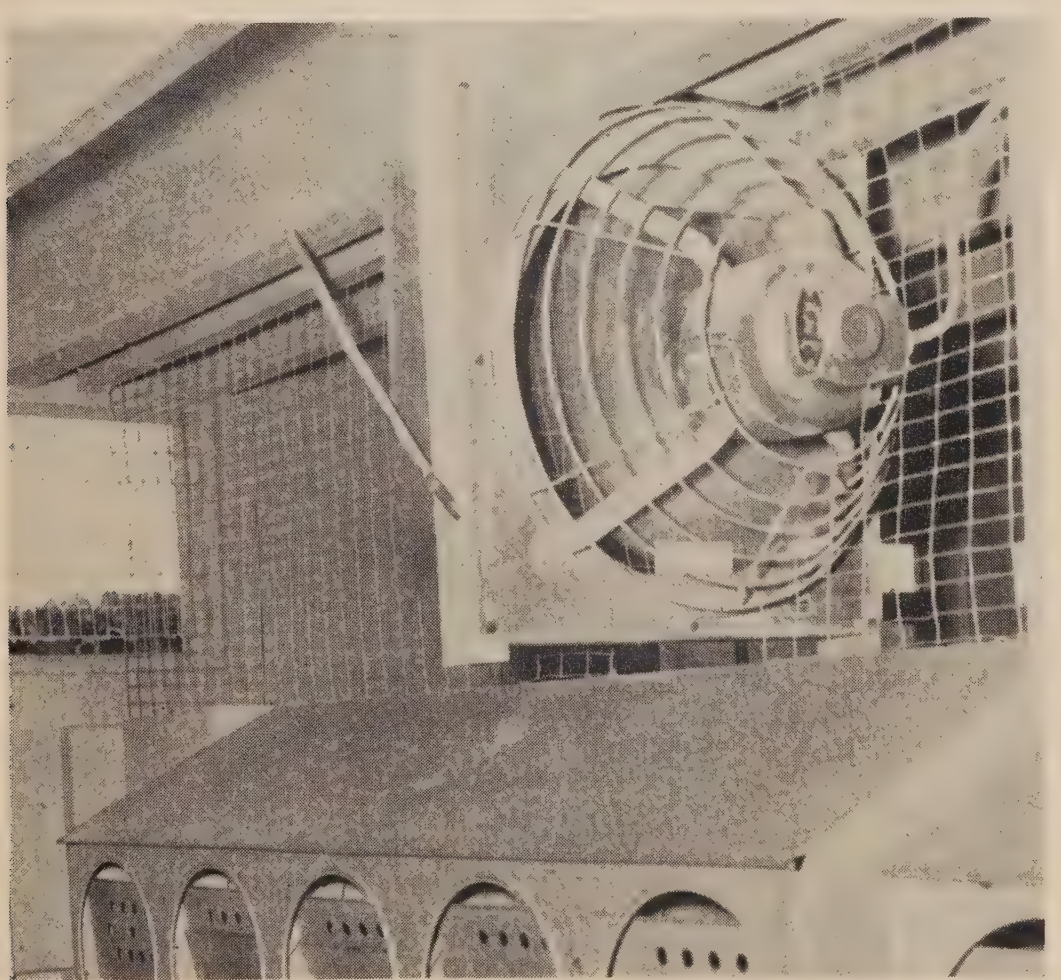


Figure 9—View of fan installed over double pen partition and facing the sliding wall outlet.

In winter the upper parts of windows located in the center of the available pen space on each side of the wall outlet served as air inlets. The size of these was adjusted to about 1 inch by 30 inches per 100 laying birds. The sliding trap outlet was adjusted to obtain a gradual change of air in the laying pen. The thermostat was set at 35°F.

The fan system of ventilation was compared with the ordinary gravity system in two poultry houses, 25 feet long by 25 feet deep. During the winters in the period 1954-56, 34 occasional adjustments were needed in the first case to provide ideal conditions of ventilation in the laying house, as against 1,047 such adjustments for the gravity system. Moreover, during these three consecutive winters, in only one instance did the litter become very wet and caked under the fan ventilation system, while in the house ventilated by gravity alone bad litter conditions occurred on twelve different occasions. The benefits of fan ventilation were obtained without increasing the total quantity of litter material used, or the labor required to keep the litter in right condition.

Again when a fan ventilation system was installed in a laying house of 800 birds capacity, divided in four pens of 25 feet by 25 feet, results obtained were even more striking. For instance, the litter remained very dry during the entire laying season without being stirred or limed. Furthermore, no litter material was added after it was built up to a depth of about 6 inches.

The great efficiency of the fan ventilation system results from its capacity to change the air gradually in the poultry house and to utilize fully the animal heat to remove moisture from the litter.

## ILLUSTRATION STATIONS

R. Caron

The Ste. Anne de la Pocatiere district covers all the counties of the south shore of the St. Lawrence River from Dorchester to Gaspé North, including the Matapédia Valley. It comprises also Montmorency and Portneuf counties on the north shore. During the 5-year period, the Illustration Station operated by Mr. Philippe Bouchard at Luceville was closed and that of Notre Dame du Lac, which was operated by Mr. Georges Plourde, was transferred to the farm of Mr. Gérard Cloutier of the same address. Altogether, nine Stations have been operated during this period.

The locations of these Stations and the names of the operators who have co-operated with the Experimental Farm for all or part of the period from 1952 to 1956, inclusive, are as follows:

| *Operator* | *Address* |
|---|---|
| Belzile, Eugène ..... | Amqui, Matapédia Co. |
| Labrie, Ls. Philippe .... | Cap Chat, Gaspé North Co. |
| Lemieux, Jos. C. ..... | L'Islet, L'Islet Co. |
| Bouchard, Philippe ..... | Luceville, Rimouski Co. |
| Plourde, Georges ..... | Notre Dame du Lac, Témiscouata Co. |
| Nadeau, Alcide ..... | Riviere du Loup, Témiscouata Co. |
| Gaudreau, Hilaire ..... | St. Paul, Montmagny Co. |
| Rousseau, J. Adélard ... | St. Pierre, I.O., Montmorency Co. |
| Aubé, Albert ..... | St. Vallier, Bellechasse Co. |

Dairying and livestock production are the major agricultural pursuits in this district and, in consequence, most of the farm activities are centered around these farm enterprises. As the operators of the Illustration Stations, as well as other farmers, become more familiar with alfalfa growing and grass silage, the cropping systems of the Station farms are gradually shifting towards grassland farming.

Since 1955, experimental projects have been started in collaboration with other Divisions as follows

(1) potassium deficiency study in alfalfa
(2) pasture seed mixture test
(3) nitrogenous fertilization of hay meadows
(4) strawberry variety test and
(5) cereal variety test.

### Crop rotations

A 5-year rotation with one year of grain and four years of hay is established on nearly every Illustration Station farm. Such a cropping system has been introduced to meet the requirements of livestock for an abundance of good quality forage.

### Pastures

Bird's-foot trefoil, as well as ladino clover, introduced during this period have proved useful in the establishment of pasture swards. A complete fertilizer formula such as 2-16-6, applied at the rate of 1,000 pounds every three years in the spring as top dressing, gave the best results for the five treatments under test. This pasture fertilization program gave an increase in yield of 4.3 tons of green matter per acre. Furthermore, the percentage of legumes in the sward was increased by 8 per cent.

### Hay meadows

Long-term hay meadows are gaining in popularity amongst farmers of this district with the introduction of appropriate seed mixtures and better management. On some Illustration Stations, 6-, 7-, and 8-year-old productive meadows can be seen.

The best seed mixture used so far for long-term meadows is the following: timothy, 5 pounds; brome grass, 8 pounds; alfalfa, 5 pounds; red clover, 3 pounds. As to fertilization on soils of average fertility, satisfactory results have been obtained with a basic application of 500 to 600 pounds of 2-16-6 at seeding time, followed by 15 to 20 tons of manure as top dressing after the first-year hay crop has been stored and 500 pounds of 2-16-6 every second year from the first hay crop. This was found to be the case on the Illustration Station at St. Vallier, where complete grassland farming has been followed for the past twelve years. It should be kept in mind that alfalfa remains the basic legume in a long-term meadow farming program. Lime must be used as required.

### Cereals

Since the acreage in cereals has been reduced in favor of forage crops, efforts are being made to increase the yield by better field management and by the use of more suitable varieties. Cereal variety tests have been under way since 1950. These tests are designed to permit a continuous evaluation of new varieties and their probable adaptation to conditions encountered in areas where Illustration Station farms are located.

### Potatoes

A potato fertility test carried at Luceville in Rimouski County, from 1947 to 1952, inclusive, resulted in the following conclusions. Current formulae recommended are higher in potash than necessary, particularly when using the 1,800-pound level of the 5-10-13 formulation, similarly rates of application generally used by farmers in the district provide too little nitrogen and phosphoric acid for maximum economic response. Current recommendation

for fertilization of potatoes in a 4-year cropping program would be 1,000 to 1,200 pounds of 6-12-10 without manure or 500 to 600 pounds of 6-12-10 with manure.

### Livestock

Illustration Stations of this district kept an average of 28 head of cattle per farm, mostly purebred stock with an average of $108 per head for all ages. Dairying remains the main source of income with over 60 per cent of the total farm revenue derived therefrom. During this past 5-year period, the Illustration Stations sold the following breeding stock to farmers: 60 bull calves, 74 heifer calves, 82 swine, and 44 sheep. Furthermore, 2,796 dozen hatching eggs were supplied to local co-operative hatcheries.

### Farm capital

Total farm capital investment on these Stations increased from $21,748 per farm in 1952 to $25,293 per farm in 1956, on the average, an increase of 16 per cent.

The distribution of farm capital in 1956 between the different categories is as follows (figures in brackets are for 1952):

| | | |
|---|---|---|
| Land and buildings | 42.0% | (45%) |
| Livestock | 19.0% | (17%) |
| Machinery | 18.5% | (17%) |
| Feeds and supplies | 8.0% | ( 5%) |

The changes in distribution of farm capital during this 5-year period are relatively minor, the most significant being a 3 per cent decline in the proportion in land and buildings which is offset by a 3 per cent increase in feeds and supplies on hand.

Cat. No. A56-219/1956

THE QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1958